INDIA RUBBER WORLD

OUR 65th YEAR

A BILL BROTHERS PUBLICATION

MARCH, 1954

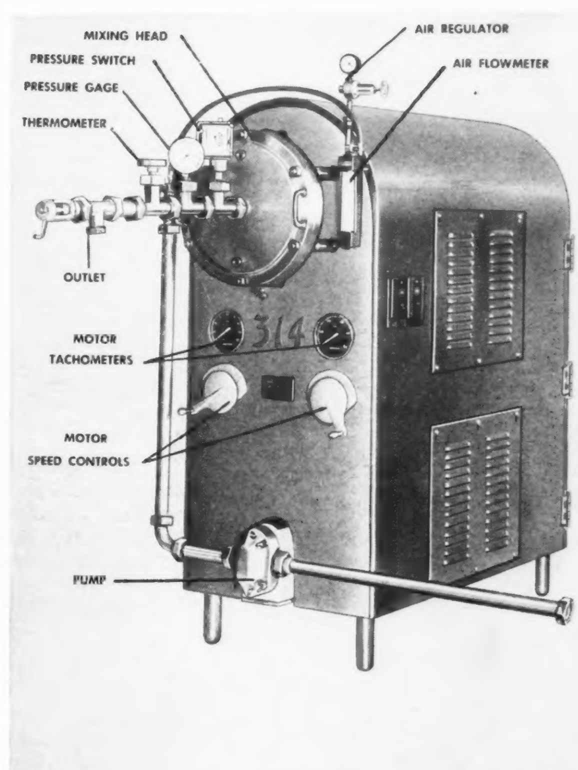
India RUBBER WORLD, March, 1954, Vol. 129, No. 6. Published monthly by BILL BROTHERS PUBLISHING CORP. Office of Publication, 1309 Noble Street, Philadelphia, Pa., with Editorial and Executive Offices at 386 Fourth Avenue, New York 16, N. Y., U.S.A. Entered as Second Class Matter at the Post Office at Philadelphia, Pa., under the act of March 3, 1879. Subscription United States and Mexico, $5.00 per year; Canada, $6.00; All other Countries $7.00; Single Copies 50 cents. Address Mail to N. Y. Office.

THINKING ABOUT GOING INTO FOAM RUBBER?

Here is a mixer to put you in at a profit!

If you are thinking of making foam rubber products, you certainly want the best equipment available for making the highest quality product at the least cost. One Oakes Continuous Automatic Mixer will do the work of a battery of the old style, conventional batch mixers—in fact it *is* doing it in a long list of representative plants throughout the world.

The reasons for the widespread adoption of Oakes equipment are many. Mixing is continuous and automatic. There are easy, instant push-button controls. Predetermined density can be held uniformly. Production of superlative quality can be had up to 900 pounds per hour with the smaller Oakes model; up to 1800 pounds per hour with the larger. Savings in latex and all other formula materials of as much as 15 per cent have been realized. Savings in reduced "rejects" have been up to 75 per cent. In plants with production upwards of 1000 pounds an hour savings of as many as six persons in labor force have been reported. Less floor space is needed; refrigerated, air-conditioned mixing rooms are unnecessary. These and other features have made this preferred equipment everywhere.

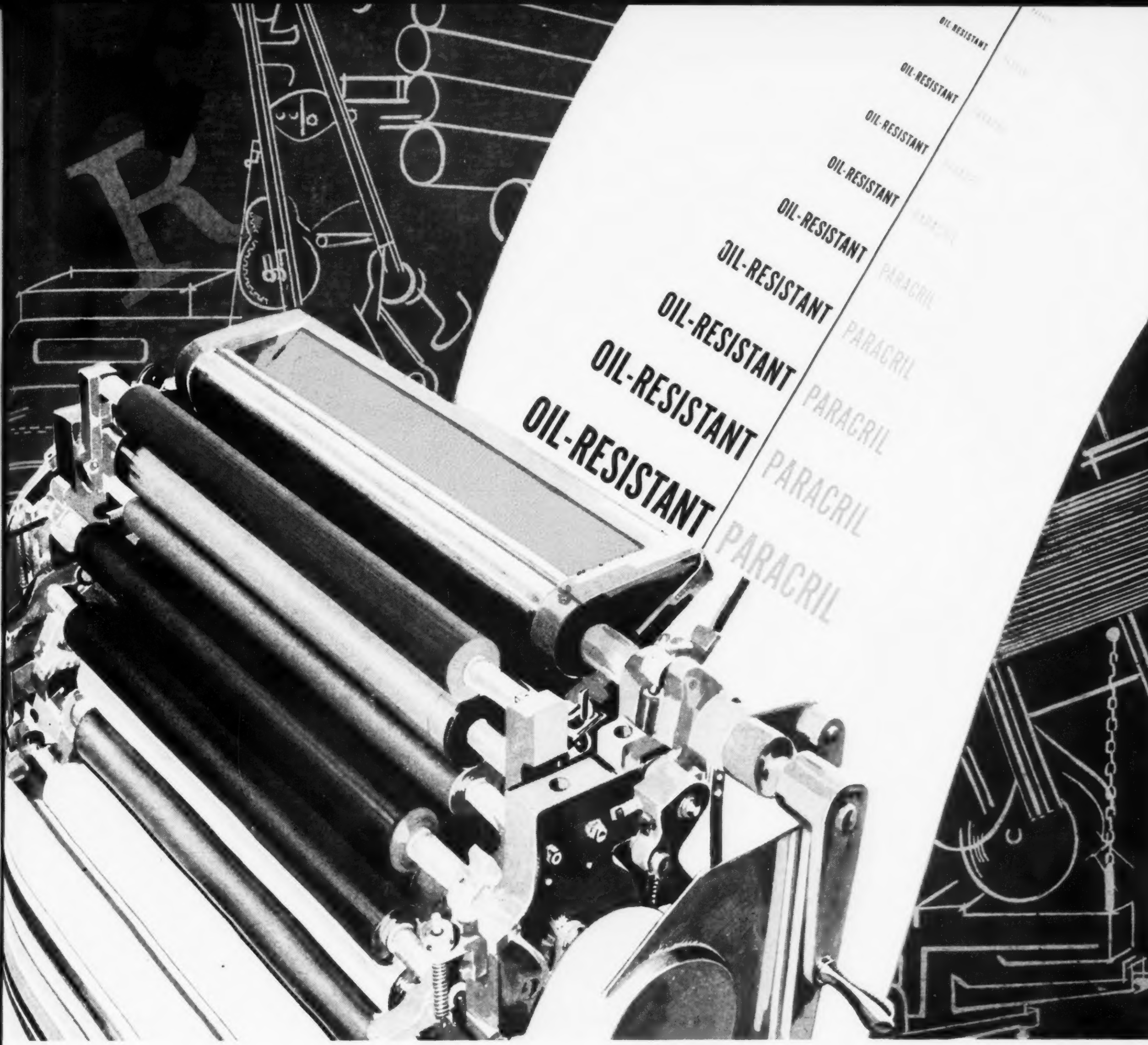


Oakes Continuous Automatic Mixer

Available only through

THE E. T. OAKES CORPORATION

Islip, Long Island, New York



n printing rollers, too...

PARACRIL "makes a good impression"!

oday's **oil-based printing inks** require printing rollers th maximum oil resistance as well as good resilience. The bber roller covers must have great stability to remain free m high and low spots. And, under the stresses of modern nting equipment, they must be extremely durable for g, efficient service life.

Little wonder **Paracril®-covered rollers** have made such good impression!"

Paracril chemical rubber is *outstanding* for its resistance animal, mineral, and vegetable oils, fats, and greases. And it combines good resilience, high abrasion resistance, and excellent resistance to aging, with extreme dimensional stability.

This unique, easy-processing chemical rubber is available in a range of property combinations, in both bale and crumb form. And it may be blended with other rubbers or plastic resins to impart special properties—used practically *wherever* a rubber or rubber-like material is needed.

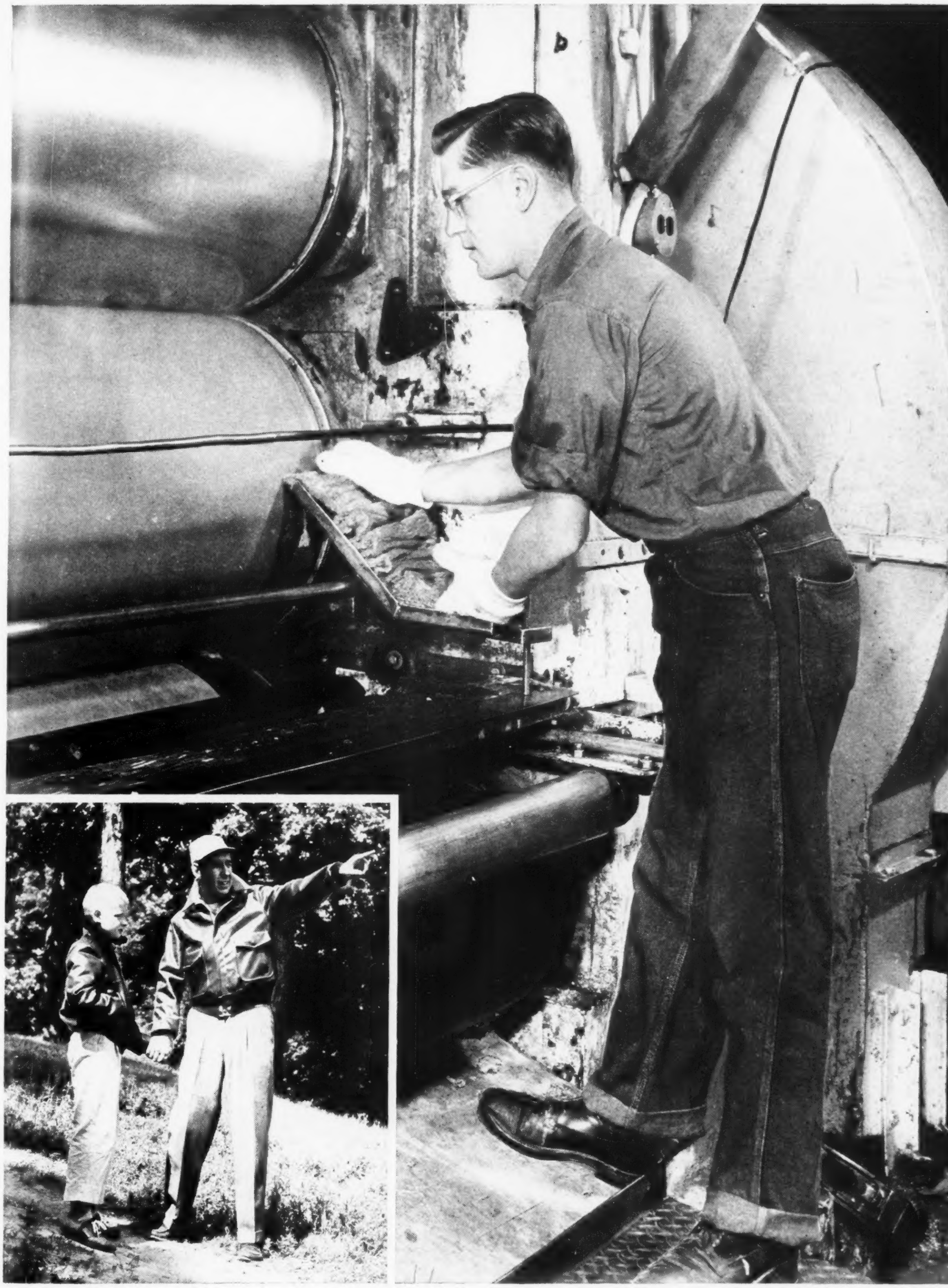
Find out more about Paracril's advantages and how they can help *you*. Write on your letterhead to the address below today.

Naugatuck Chemical

133 ELM STREET
NAUGATUCK, CONNECTICUT

Division of United States Rubber Company

IN CANADA: NAUGATUCK CHEMICALS DIVISION • Dominion Rubber Company, Limited, Elmira, Ontario

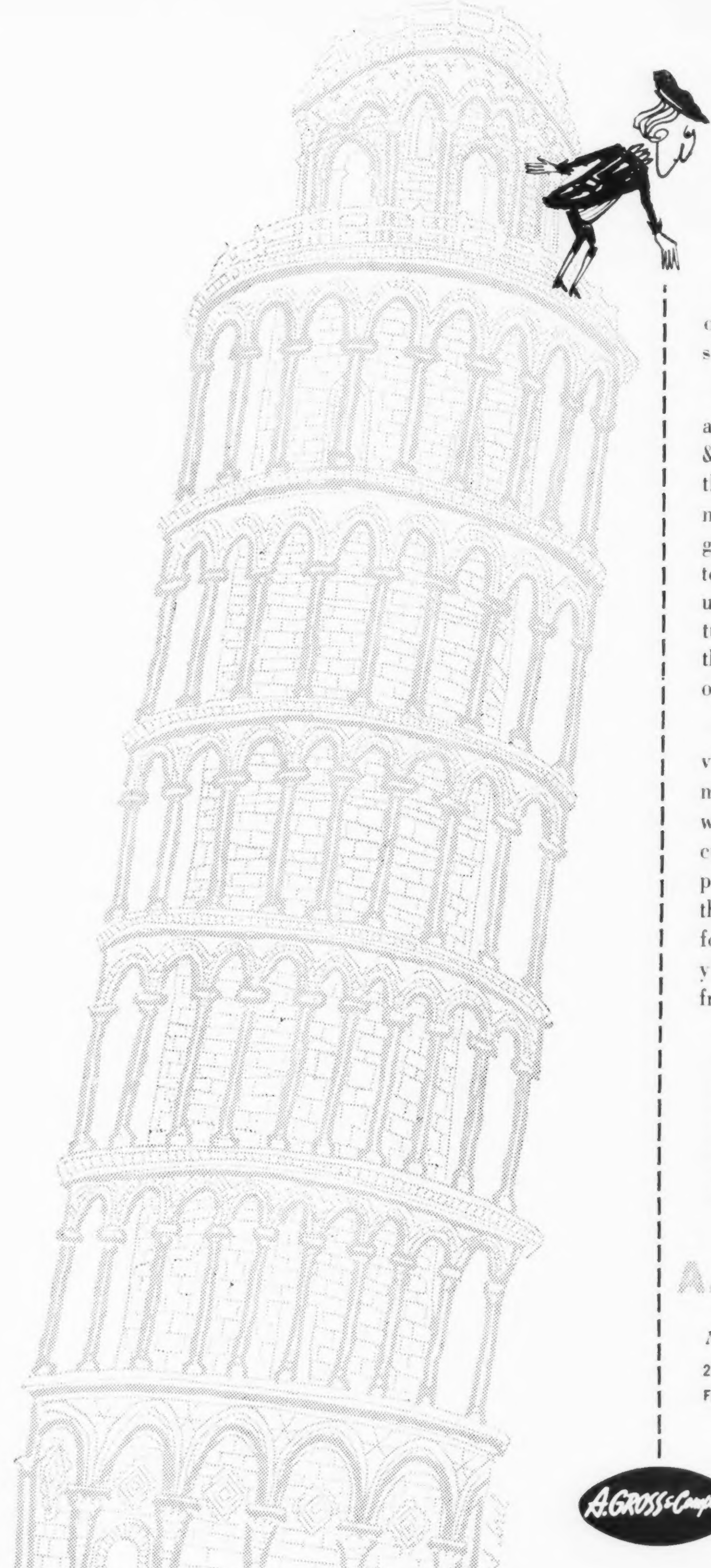


TOLEX MAKES these jackets soft, pliable, waterproof and highly resistant to scuffing or abrasion. PLIOVIC permits this fabric-reinforced sheeting to be calendered faster and at lower cost.

Tolex T. M. Textileather Corporation, Toledo, Ohio

We think you'll like "THE GREATEST STORY EVER TOLD"—every Sunday—ABC Radio Network—THE GOODYEAR TELEVISION PLAYHOUSE—every other Sunday—NBC TV Network

Chemigum, Pliobond, Pliolite, Plio-Tuf, Pliovic—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

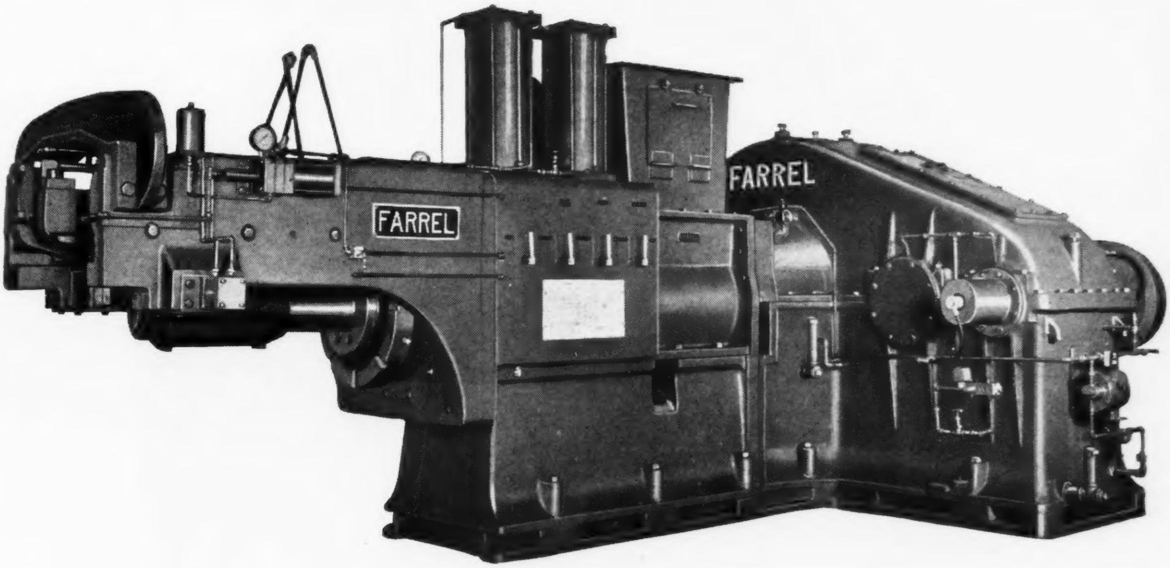


ower
ngly

may
Gross
Acid
o our
tilled
ma-
f the
ufac-
lieve
ssity

oper
bber
ially
and
il is
me-
are
soap
or a

ny



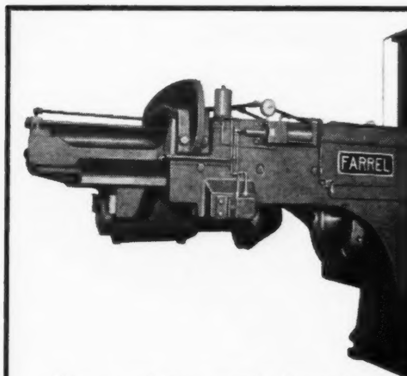
This NEW Giant Extruder can take the output of two size 11 Banbury* Mixers

This new extruder can be used with one size 11 Banbury mixer on short-cycle operation of 1½ to 2½ minutes, or with two size 11's for longer cycles. The extruder is installed under the Banbury, and in the case of two mixers, a belt conveyor carries the discharge from the second mixer to the extruder hopper, alternating with the gravity feed from the first mixer. With this arrangement, production can be maintained at a rate of 10,000 to 18,000 pounds per hour. Operation is entirely automatic.

An electric eye in the feed hopper actuates an air-operated clutch in the drive to stop the machine when the hopper becomes empty between batches. This keeps the screw always full of stock, so that the slab discharged is uniform and unbroken.

Extruders of this size provide the answer to full utilization of short-cycle operation of large-capacity Banbury mixers. The bottleneck of a group of milling operations following Banbury processing is eliminated, together with all manual handling connected with milling. Flow of material is accelerated and simplified; also the plasticity of stock worked by the screw in a single pass in the extruder chamber is more uniform than that of milled stock.

Where the desired rate of production warrants an installation of this size, Farrel-Birmingham's long experience in the design and manufacture of extruding machines takes the risk out of the investment. Write for complete details.



These machines extrude through a circular die. The stock is slit at the die exit to form a continuous slab, approximately 50 inches in width, which can be cut to desired lengths.

A retractable cone, operated by an air-hydraulic system, facilitates rapid automatic cleanout (see above photo). A hydraulically operated locking device keeps the cone in positive operating position. Gauging blocks of different thicknesses, which are mounted on the carriage, are used to adjust the die opening.

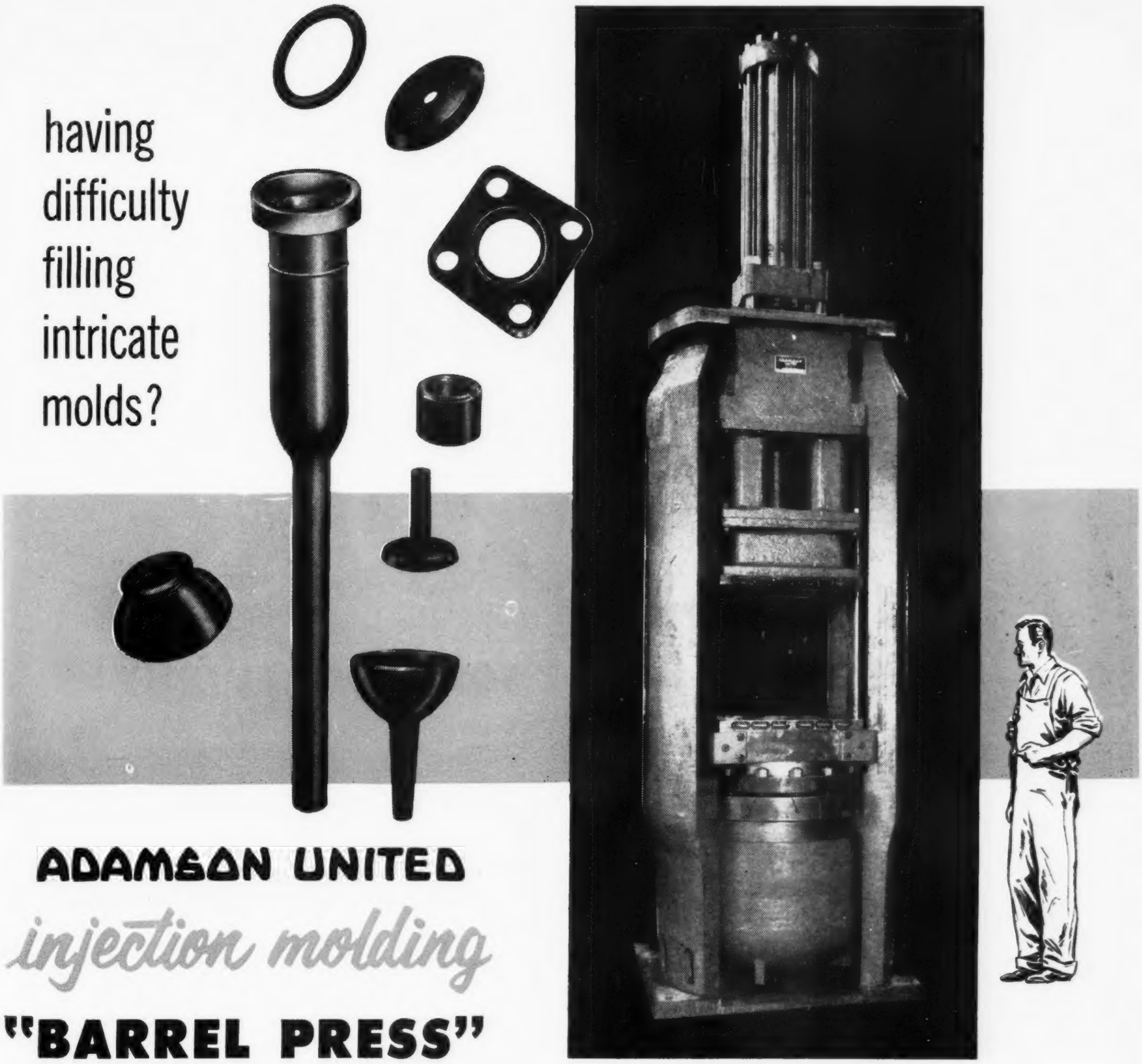
FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONNECTICUT
Plants: Ansonia and Derby, Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Akron, Chicago, Los Angeles, Houston

FB-847

Farrel-Birmingham®

*Trade-mark


VINYL COMPOUNDS
Custom Mixed by
CARY CHEMICALS



...... may solve your problem

Designed for fast, automatic stock injection, higher mold clamping forces and greater accuracy in the production of molded rubber products, this new ADAMSON INJECTION BARREL PRESS eliminates many of the problems encountered in the use of conventional rod-type units.

A solid ram equal in diameter to the platen dimensions supports practically the entire bolster area. Platen pressures up to 1800 lbs. per sq. in. can be transferred to the mold with a minimum of deflection and "flash," on the same accumulator lines used for operating your present presses. Faster, high pressure press work can be maintained over long periods with less down time; and because of the extreme accuracy of the press, material savings can be made in product finishing costs.

We'll be glad to furnish you details on the new ADAMSON INJECTION MOLDING BARREL PRESS, or on any other type of rubber processing equipment. Your inquiry will entail no obligation.

ADAMSON UNITED COMPANY
730 Carroll Street, Akron 4, Ohio
SALES OFFICES IN PRINCIPAL CITIES

Subsidiary of United Engineering and Foundry Company • Plants at Pittsburgh, Vandergrift, New Castle, Youngstown, Canton

S

WORLD

YOU SAVE 3 WAYS

with Horse Head Unit Loads

1. SAVE ON UNLOADING

Save up to $40 a car by unloading Horse Head shipments with a fork lift-truck.

2. SAVE ON HANDLING

Cut in-plant handling cost up to 33%.

3. SAVE VALUABLE STORAGE SPACE

You can stock up to 180 bags (4½ tons) of Horse Head pigments in only 14 sq. ft. of floor space—a saving of up to 50% in space.

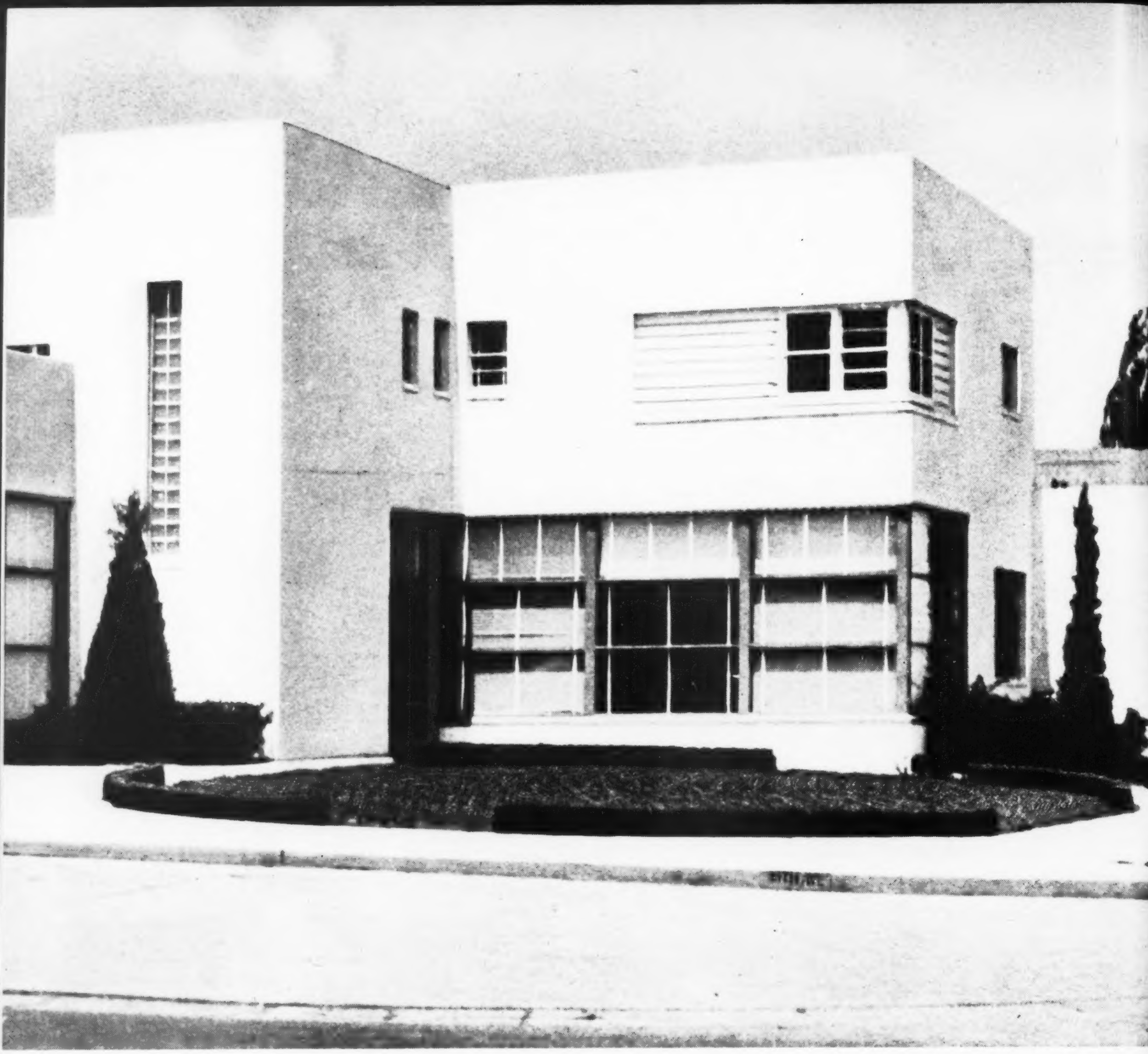
The details of these savings are explained in this booklet. Write for your copy now.

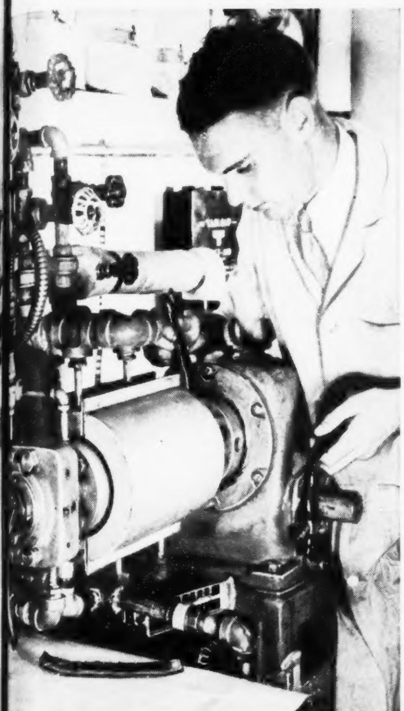
THE NEW JERSEY ZINC COMPANY

Founded 1848

160 Front Street, New York 38, N. Y.

HORSE HEAD PRODUCTS

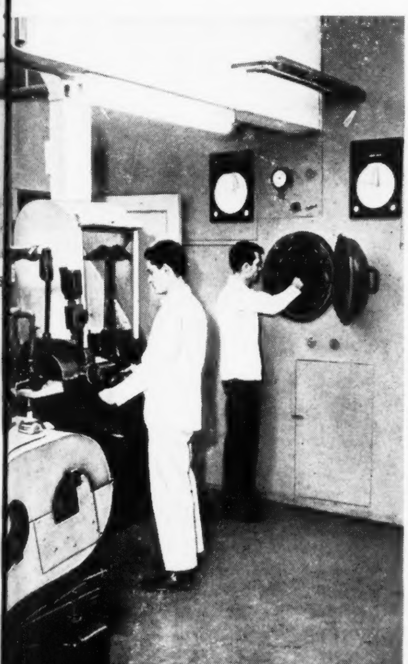




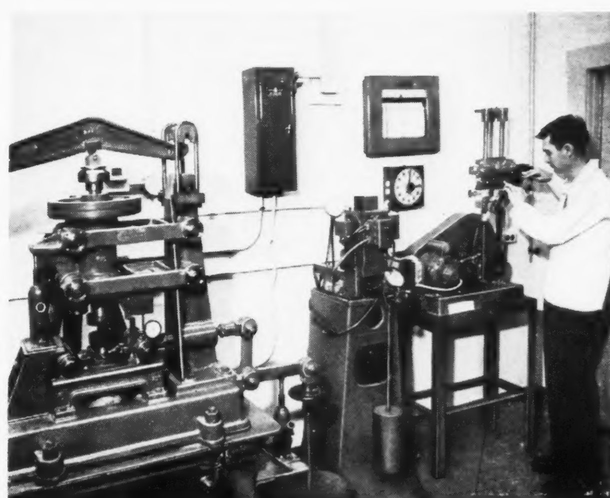
al tuber (one-half size) for evaluation of ial extruding compounds.

Scott tester for determination of tensile strength of rubber compounds.

Curing press, completely enclosed in operation to provide exact curing temperatures.

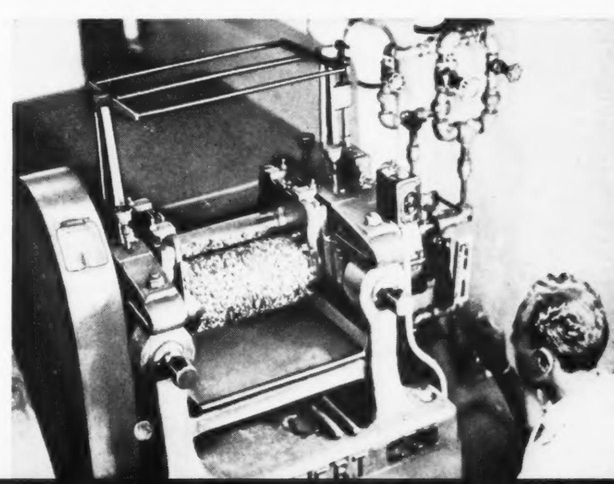


ion of laboratory mill room, showing rubber s and open steam vulcanizer.

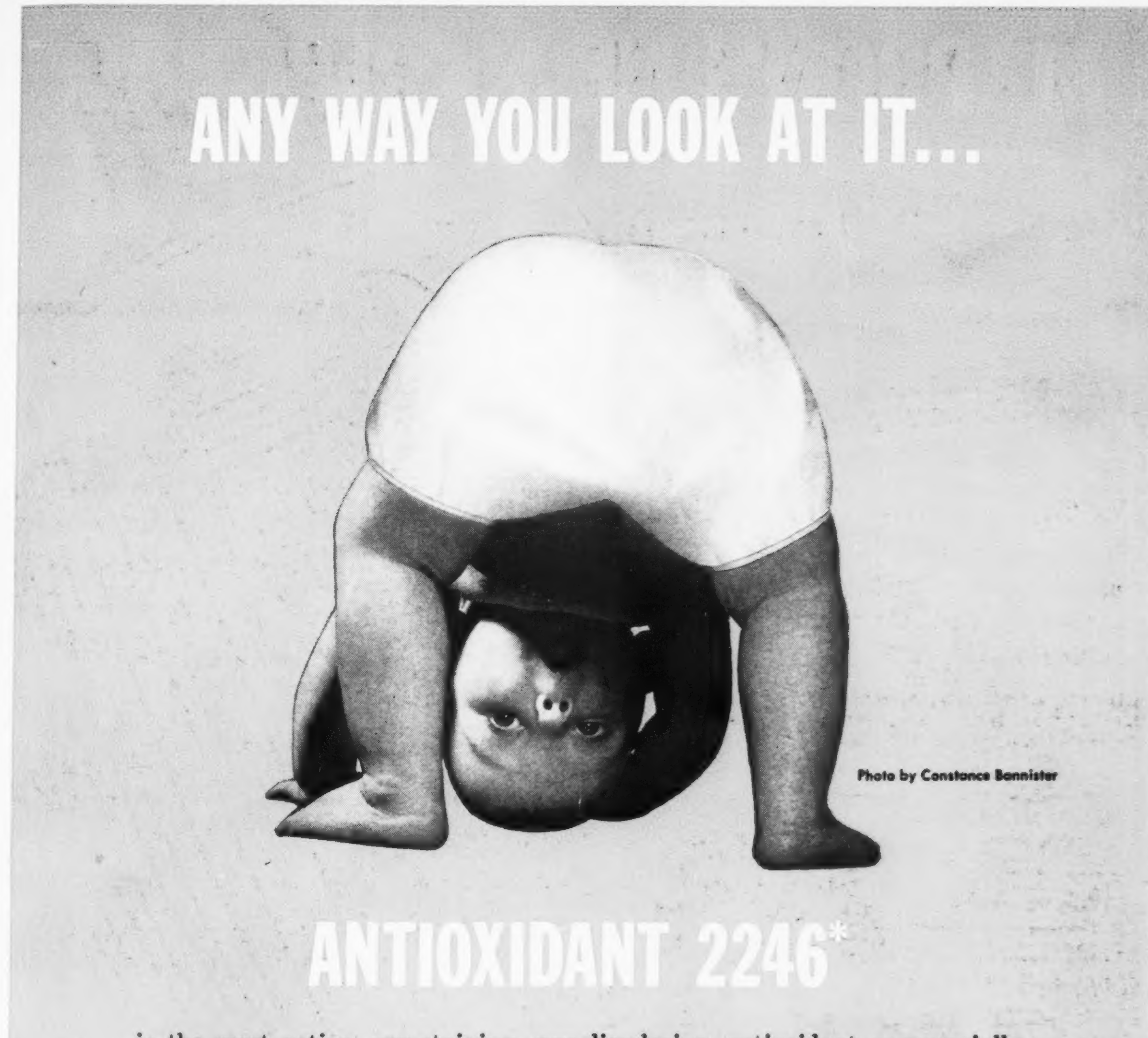


St. Joe Flexometer and other testing equipment used in evaluating rubber compounds for industry.

Rubber mill on which rubber test batches are compounded.

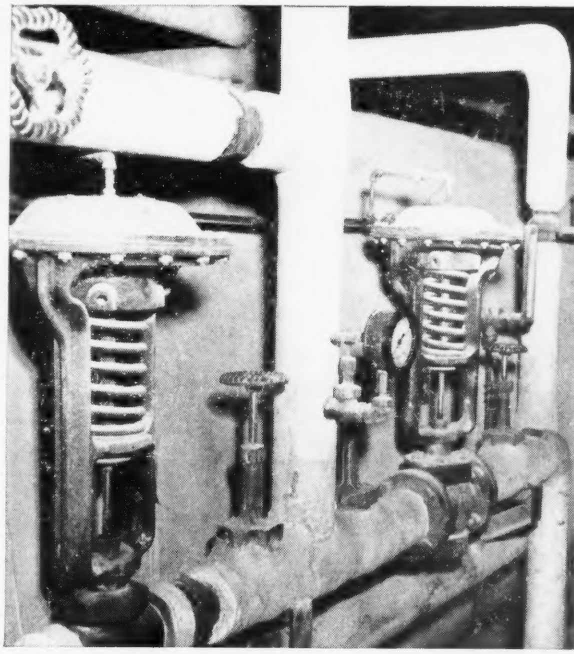


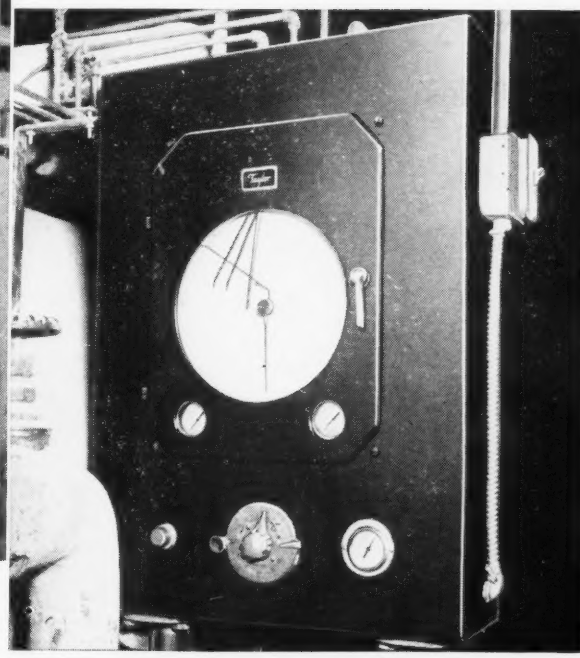

TRIM FLASHING in a Flash
and Clean as a Whistle!
Western's RMH Machine
cuts the cost of trimming as much as 75%
a factory in a foot of space!
FEATURES: Cuts on replaceable hardened steel plate. Foot control speeds operation. Simple, positive pressure adjustment. ½ H.P. motor. Cutting area approx. 8½" x 9".
CUTS, PUNCHES and TRIMS in one swift operation!
DIES ARE OUR SPECIALTY
2 and 3 level dies are made for RMH. Change dies in just a few seconds with positive alignment.
FLASHING TRIM DIES
CLICKER DIES
WALKER DIES
I. D. and O. D. DIES
MALLET DIES
MACHINE DIES
POSITIVE SAFETY FEATURES
Machine cannot trip accidentally. Operator can view entire operation.
GET THE FULL STORY on Western Machines and Dies by sending for our free illustrated catalog today.
WESTERN SUPPLIES CO.
SEND SAMPLES of parts to be cut and flash trimmed for our recommendations.
For Versatility– "GO WESTERN"
Western SUPPLIES CO.
2920 CASS AVE., ST. LOUIS 6, MO.


ANY WAY YOU LOOK AT IT...
Photo by Constance Bannister
ANTIOXIDANT 2246*
is the most active, non-staining, non-discoloring antioxidant commercially available. Ideal for white and light-colored stocks. Send for technical bulletin.
*Trade-mark
Calco
Calco
AMERICAN Cyanamid COMPANY
INTERMEDIATE & RUBBER CHEMICALS DEPARTMENT
BOUND BROOK, NEW JERSEY

SURE CURE

AT LOWEST COST





YES, this Taylor Vulcanizer Control System is delivering consistently uniform cures at lowest cost for the Goodyear Tire and Rubber Company, Akron, Ohio. It's a Taylor Packaged Unit with Double Duty Process Timer—running one of a battery of big mechanical goods vulcanizers. The operator simply loads the vulcanizer and sets the cure time. Then Taylor Control takes over with an automatically coordinated system of time and temperature . . . faithfully repeating each cycle again and again. Results for Goodyear—

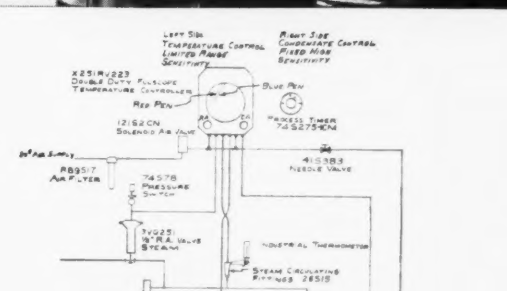
Increased production through increased efficiency . . . fewer rejects.

Greatly reduced costs through steam savings.

A big saving in manpower. Operators released for other duties—and *from* all responsibility for efficient processing.

We believe there's a moral in this Taylor Packaged Unit story for anyone who's interested in closely coordinated control of any important rubber process. It might be called *instrumental teamwork*, and it breaks down into three points:

1. **The instruments in every Taylor Packaged Unit are designed from the very beginning to work together.**
2. **You have the economy and dependability of simple air-operated control.**
3. **You have a complete control system in one neat, compact package . . . good houskeeping for your plant and easy maintenance for your men.**

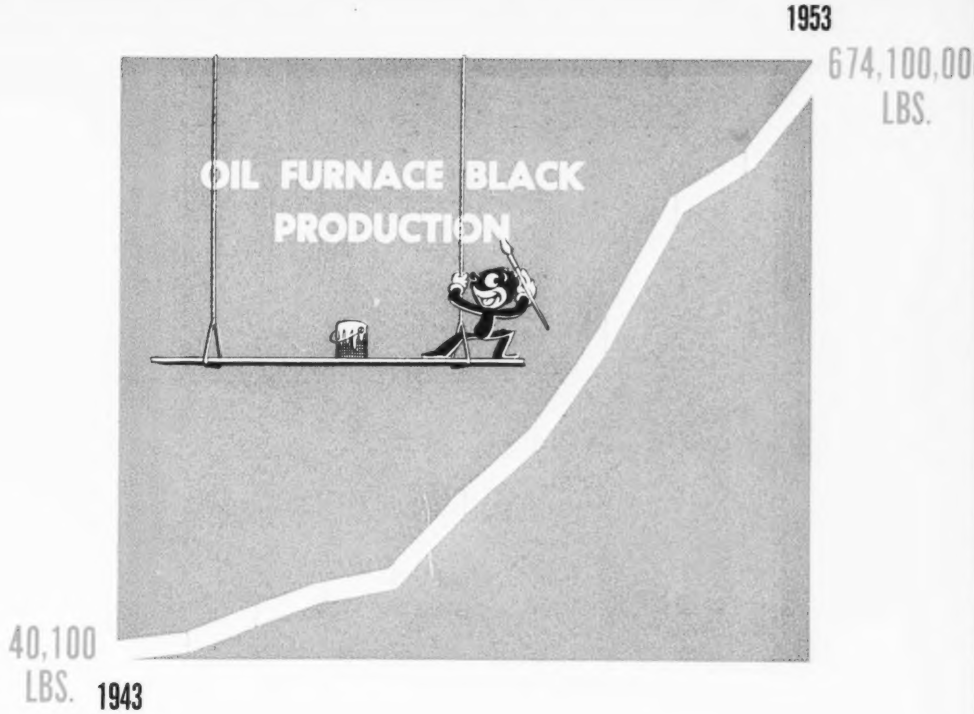


Ask your Taylor Field Engineer! He'll analyze your problem, then he'll turn the job over to Taylor Application Engineers, specialists in instrumentation. Taylor Instrument Companies, Rochester, N.Y., and Toronto, Canada.

▼ ▼ ▼

Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.

TAYLOR INSTRUMENTS MEAN ACCURACY FIRST



A decade of progress

Some of the most difficult technical problems imaginable have been set before the American rubber industry by the fortunes of war and peace.

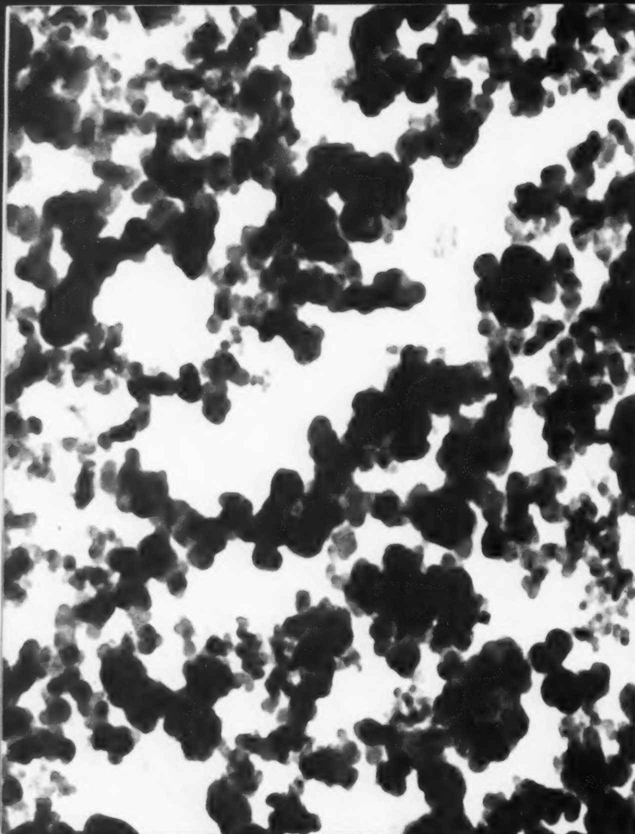
Yet the rubber industry, with characteristic courage and competence, has managed to continue its drive for better products at lower costs.

Growth such as we have witnessed since 1943 in oil furnace blacks can only be based on the rubber industry's fundamental concern for efficiency and performance.

We are proud that our Philblacks contribute as they do to the rubber industry's many developments in the field of low-cost transportation.

In the years ahead we shall continue to devote our engineering and scientific skills to the many interests we share with you in the rubber industry.

PHILLIPS CHEMICAL COMPANY ***Philblack Sales Division***



50,000 X

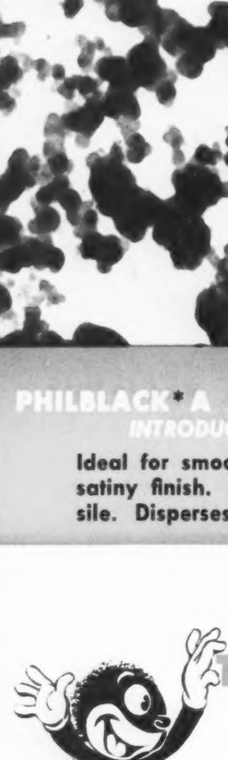
PHILBLACK* A ***FEF*** **Fast Extrusion Furnace**
INTRODUCED **December 25, 1943**

Ideal for smooth tubing, accurate molding, satiny finish. Mixes easily. High hot tensile. Disperses heat. Non-staining.

50,000

PHILBLACK* O ***HAF*** **High Abrasion Furnace**
INTRODUCED **September 17, 1947**

For long, durable life. Good electrical conductivity. Excellent flex life. Fine dispersion in new or reclaim polymers.



The four Philblacks ... and how they grew

In the early 1930's, Phillips Petroleum Company was the largest supplier of natural gas for carbon black manufacture.

On the surface this seemed like an ideal situation, but Phillips was not satisfied with the orthodox methods of carbon black manufacture.

The channel process then so widely used converted less than five per cent of the carbon in the gas into carbon black. This extremely low efficiency was subject to close scrutiny from several viewpoints:

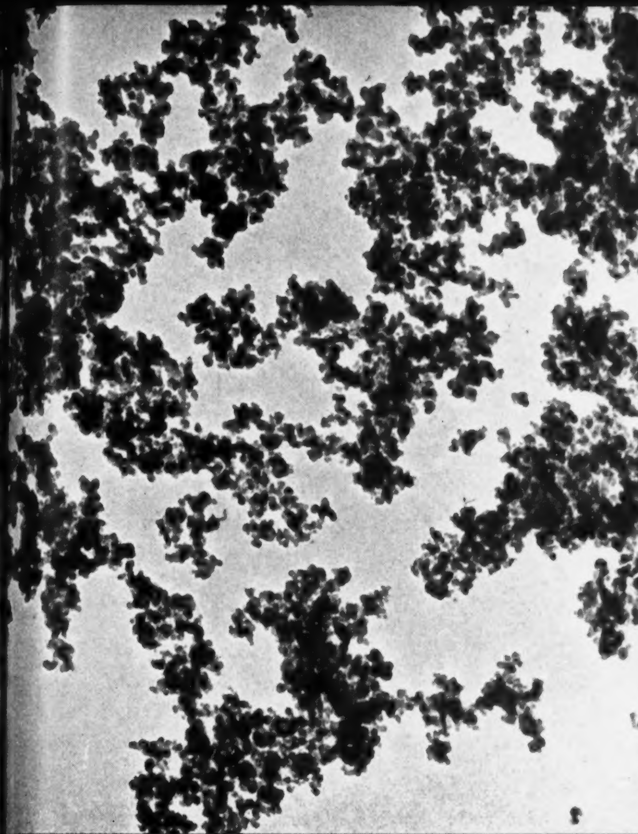
1. A return of about two pounds of channel black per thousand cubic feet of natural gas represented a questionable return on a valuable natural resource.

2. As natural gas was upgraded to serve higher value markets, the supply available for channel plants was certain to shrink.

3. The inefficient channel process could be expected to encounter critical competition from more efficient methods of carbon black manufacture.

In 1936, Phillips began a program to develop a more efficient process using a liquid hydrocarbon feed instead of gas. Pilot plants demonstrated carbon

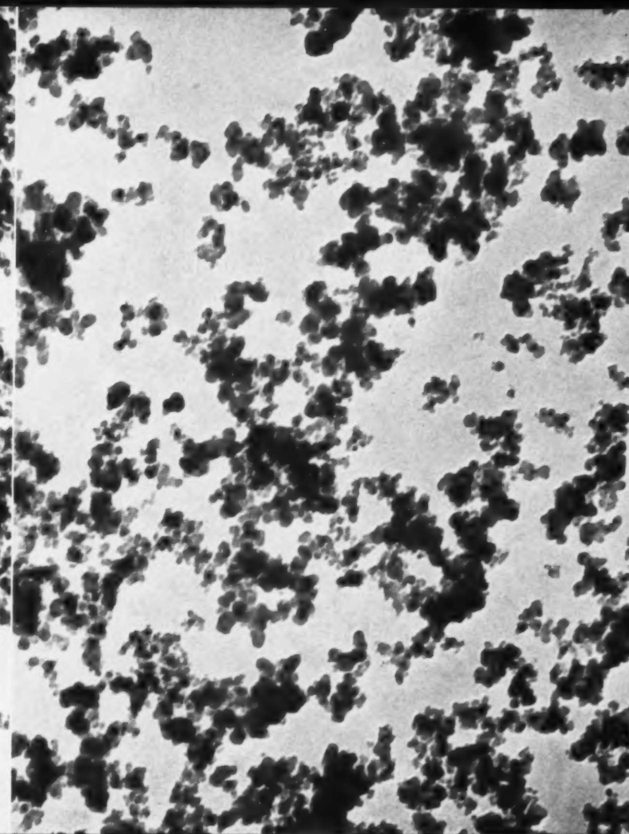
*A TRADEMARK



50,000 X

PHILBLACK*E ***SAF*** **Super Abrasion Furnace** INTRODUCED **October 6, 1952**

Toughest black yet. Extreme abrasion resistance. Withstands aging, cracking, cutting and chipping like a champion!



50,000

PHILBLACK* I ***ISAF*** **Intermediate Super Abrasion Furnace** INTRODUCED **May 25, 1953**

Superior abrasion resistance at moderate cost. Excellent resistance to cuts and cracks. More high speed tread miles for less money.

black recoveries in excess of 50 per cent. Thus, before Pearl Harbor, the Philblack A process was firmly in hand. And under wartime conditions of steel shortage, the high efficiency and low steel requirements of the Philblack process were extremely helpful in making large quantities of the new black promptly available for the war effort.

After the exigencies of war eased, Phillips began an intensive study to develop a new oil furnace black superior in reinforcement to channel black when incorporated in natural or synthetic polymers. This new black, Philblack O, came on the commercial scene in September 1947.

Rubber manufacturers soon found that Philblack O and synthetic rubber produced tire treads that consistently gave 30 per cent greater wear than control compounds made with natural rubber and channel black.

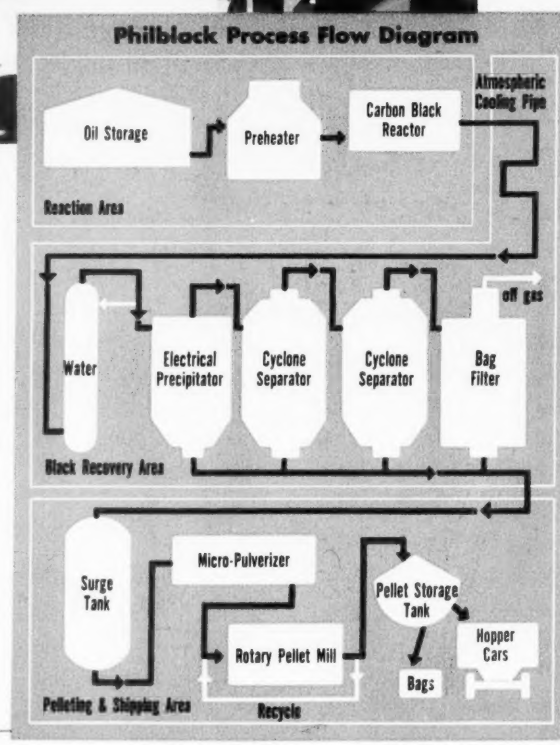
As tire makers swung over to Philblack O, Phillips engineers found themselves designing and constructing what has become the world's largest plant for the production of furnace blacks.

Continued research by Phillips resulted in the development in 1952 of Philblack E, a Super Abrasion Furnace black of higher structure and still finer particle size. This extraordinary black, Philblack E, is superior to all other blacks in industrial applications requiring extreme resistance to abrasion and to cut and crack growth. Philblack E is a specific answer to the excessive wear encountered by tires on today's more powerful, faster automobiles.

Tire manufacturing demands for a sturdy black at moderate cost initiated the production in 1953 of an Intermediate Super Abrasion Furnace (ISAF) black – Philblack I. This black imparts superior abrasion resistance at remarkably low cost. It also provides excellent resistance to cut and crack growth and gives increased tire mileage at high speeds.

With four Philblacks in production, the end is not yet in sight by any means. Research on carbon black proceeds with one chief aim:

". . . to help the rubber industry in its steady advance toward higher quality and lower costs . . ."



World's largest and finest furnace black plant at Borger, Texas produces Philblack for you

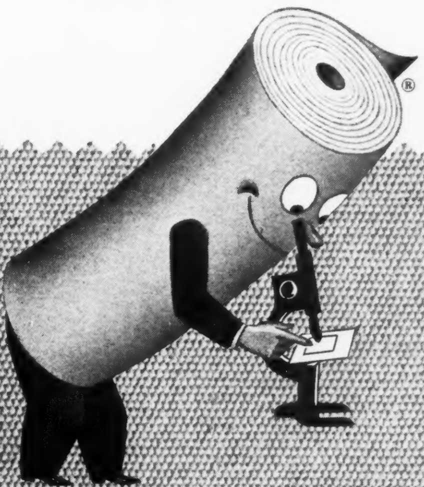
NOW is the time to investigate fully the many advantages Philblack can bring to your products.

Whether you are a customer or a prospective customer, our long experience with oil furnace black is fully available to you. PHILLIPS CHEMICAL COMPANY, Philblack Sales Division, 318 Water Street, Akron 8, Ohio.

SEE YOU IN LOUISVILLE . . . April 14, 15, 16

Ah, Science! How Philblack looks forward to the 65th Meeting of the Division of Rubber Chemistry, American Chemical Society! Abstruse, technical papers . . . incomprehensible slides . . . evenings filled with scientific chitchat. ***SEE YOU IN LOUISVILLE!***

UNIFORMITY Makes The Big Difference In INDUSTRIAL FABRICS



MT. VERNON FABRICS

Give You Greater Uniformity

Checking evenness of roving with Belger Tester. One of a series of comprehensive laboratory controls throughout production to assure uniformity in all Mt. Vernon-Woodberry products.

FABRICS ENGINEERED TO FIT YOUR NEEDS

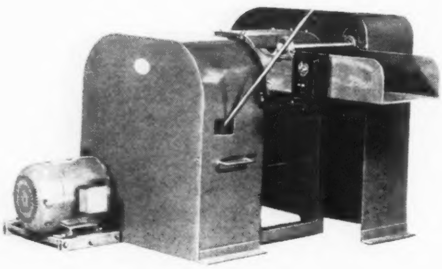
Need adaptation of an existing fabric to your special purposes? Or creation of an entirely NEW fabric — cotton, synthetic or blend — to meet your specifications? Mt. Vernon-Woodberry's staff of textile engineers is available on request to help you with your problems in development or application of industrial fabrics.

Mt. Vernon-Woodberry Mills

Main Office: 40 Worth St., New York
Branch Offices: Chicago • Atlanta
Baltimore • Boston • Los Angeles

TURNER HALSEY
COMPANY
Selling Agents

Cuts Molding Blanks from extruded stock with *INCREDIBLE* ACCURACY



A rubber sole manufacturer wanted to cut extruded stock prior to feeding it into the forming presses.

The blanks had to be exactly uniform in shape and size. Too little or too much stock would result in imperfect soles or wasted material.

So a Taylor-Stiles cutter was used to cut exact sections from precut strips of the proper thickness and width assuring blanks with the required weight of stock.

In actual plant operation the manufacturer found these blanks were uniform to within 1/8 ounce!

Our engineering staff will be glad to consult with you regarding a machine to cut your molding blanks, or will be glad to make available to you our 80 years of experience in solving cutting problems in many fields.

(We also manufacture dicing cutters).

TAYLOR-STILES and Company
CUTTING MACHINES & KNIVES

16 Bridge Street, Riegelsville, New Jersey

VULCANIZED VEGETABLE OILS

—RUBBER SUBSTITUTES—

•

Types, grades and blends for every purpose, wherever Vulcanized Vegetable Oils can be used in production of Rubber Goods—be they Synthetic, Natural, or Reclaimed.

•

A LONG ESTABLISHED AND PROVEN PRODUCT

THE CARTER BELL MFG. CO.
SINCE
CARTER BELL PRODUCTS
1903
SPRINGFIELD, NEW JERSEY

Represented by:

HARWICK STANDARD CHEMICAL CO.

Akron — Boston — Trenton — Chicago — Denver — Los Angeles

Located at 1248 Wholesale Street in Los Angeles, Harwick Standard Chemical Company of California is in a position to serve the entire Pacific Coast area efficiently from warehouse stocks . . . These Technical Sales Representatives can provide helpful experience in meeting compounding and production problems for customers in rubber and plastics manufacturing . . .

D. C. Maddy is a graduate chemist with an extensive practical background in rubber and plastics compounding and production. His broad "know how" in chemical engineering can be helpful to customers who encounter problems on applications of compounding materials.

Harry A. Trechter, graduate chemist, knows both the problems of procurement, from years of experience in buying and administration, and the problems of compounding and production from direct laboratory work on a variety of rubber products. As Technical Sales Representative, his experience can be called upon by customers for answers to many problems.

These men can be called at any time through our Los Angeles office — Telephone: TRinity 8588, or by writing to 1248 Wholesale Street, Los Angeles, California.

Harwick offers a complete line of materials, precision tested for the compounding of all types of rubbers and plastics:

SYNTHETIC RESINS —

PICCOUMARON	Para Coumarone Indenes
PICCOLYTE	Hydrocarbon Terpenes
PICCOPALE	Hard Hydrocarbon Resins
PICCOLASTIC	Styrene Resins
RESINEX	Aromatic resin type softener

PLASTICIZERS —

POLYCIZER 162	Dioctyl Phthalate
POLYCIZER 332	Dioctyl Adipate
Dicapryl Phthalate	
Dibutyl Phthalate	
Tricresyl Phosphate	

RUBBER SUBSTITUTES — Vulcanized Vegetable Oils

FILLERS —

Clays and Whitings
Silene EF — Reinforcing Pigment

MOLD AND STOCK LUBRICANTS.

MAGNESIUM PRODUCTS.

CASEIN.

RUBBER-TO-METAL BONDING AGENTS

STABILIZERS —

STABELAN — E, HR Paste, Liquid and Powder

COLORS —

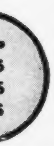
STANTONE MBS Masterbatch)
STANTONE GPE (Ground Polyethylene)
STANTONE PC (Flushed)
STANTONE Dry Colors (Pigment)
STANTONE Rubber and Vinyl Inks.

HARWICK STANDARD CHEMICAL CO.

AKRON, BOSTON, TRENTON, CHICAGO, LOS ANGELES

pur-
rolls;
lling
s; (3)
rolls.

es of
otion,
ed to

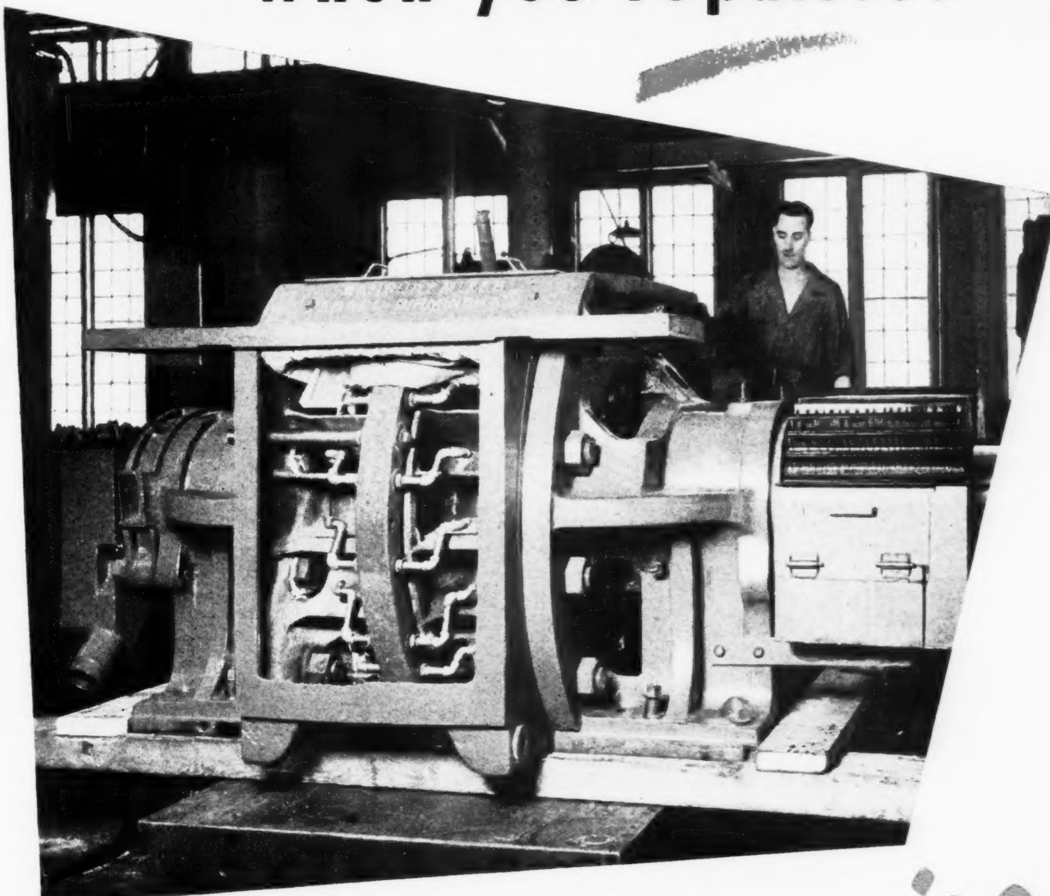


o.

n.

ORLD

when you repair...



Complete, rebuilt body, reassembled and tested, carries a new-machine guarantee.

Modernize!

At Farrel-Birmingham, the Banbury* mixer is constantly being improved in design and materials to keep pace with tougher service demands in the rubber industry, and the severe duty encountered in the production of certain types of plastics.

It will pay you to remember this when your Banbury needs rebuilding, because the modern features of design and improved materials, which are now incorporated in new Banburys, are readily adaptable to existing machines. These improvements can mean higher operating efficiency and greater wearing qualities for your Banbury.

A Banbury mixer rebuilt by Farrel-Birmingham corresponds so closely to a new Banbury that it carries a new machine guarantee. Such a guarantee provides assurance that the rebuilt machine will be "as good as new" when it is returned to service.

We carry the largest existing stock of standard parts and complete new bodies. For details contact any of the offices listed.

FARREL-BIRMINGHAM COMPANY, INC.

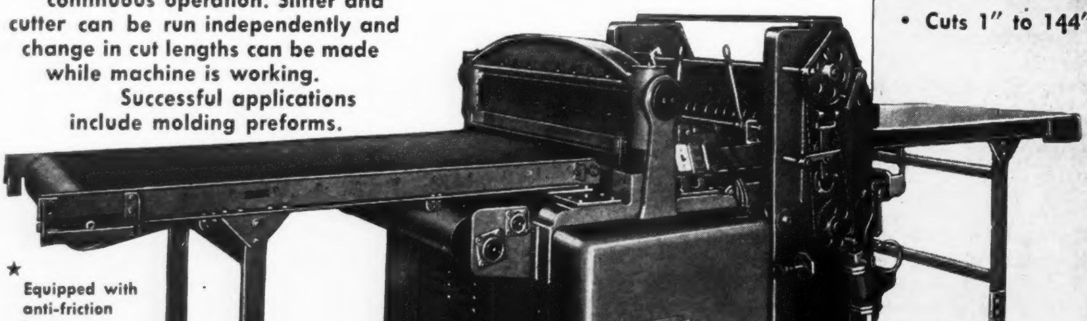
ANSONIA, CONN. (Telephone Ansonia 4-3331)

AKRON, OHIO, 2710 First National Tower (Tel. POrtage 2-8871)
CHICAGO, ILLINOIS, 120 So. LaSalle St. (Tel. Andover 3-6434)
LOS ANGELES, CALIF., 2032 Santa Fe Ave. (Tel. Lafayette 3017)
HOUSTON, TEXAS, 860A M & M Building (Tel. Preston 4472)

FB-898

*Trade-mark

Farrel-Birmingham®



INDIA
RUBBER
WORLD
A Bill Brothers Publication

MARCH, 1954
Vol. 129—No. 6

Table of Contents

Departments

Market Reviews

Statistics

India Rubber World assumes no responsibility for the statements and opinions advanced by contributors.

NBP BPA

SUBSCRIPTION PRICES
United States, $5.00 per year; Canada, $6.00; all other countries, $7.00. Single copies in the U. S., 50¢; elsewhere, 60¢.

Other Bill Publications are: In Marketing, SALES MANAGEMENT, SALES MEETINGS, PREMIUM PRACTICE. In Merchandising, FLOOR COVERING PROFITS, FOUNTAIN & FAST FOOD, GROCER-GRAPHIC, TIRES — TBA Merchandising, YANKEE FOOD MERCHANT.

A BILL BROTHERS PUBLICATION

Published monthly by

BILL BROTHERS PUBLISHING CORPORATION

Editorial and Executive
386 Fourth Ave.,
New York 16, N. Y.
LExington 2-1760

Office of Publication
1309 Noble St.,
Philadelphia 23,
Pennsylvania

Chicago Office: 333 N. Michigan Ave.
STate 2-1266

B. BRITTAIN WILSON, *General Manager*
ROBERT G. SEAMAN, *Editor*
S. R. HAGUE, *Managing Editor*
ARTHUR M. MERRILL, *Associate Editor*
ROBERT C. TOTH, *Editorial Assistant*
RUFUS H. FAIRCHILD, *Advertising Manager*
M. J. McCARTHY, *Circulation Manager*
M. A. LARSON, *Production Manager*

Chairman of Board and Treasurer
RAYMOND BILL

Vice Presidents
B. BRITTAIN WILSON
C. ERNEST LOVEJOY
WM. H. McCLEARY

President and General Manager
EDWARD LYMAN BILL

INDIA
RUBBER
WORLD

VOL. 129—NO. 6 MARCH, 1954

Effect of Moisture on Rate of Cure of Natural Rubber[1]

Rolla H. Taylor,[2] Frederick E. Clark,[3] and William P. Ball[4]

IT is a well-recognized fact that moisture must be taken into account in the precise testing of rubber. In 1928 the Physical Testing Committee of the Division of Rubber Chemistry (1)[5] reported that variations in humidity, subsequent to mixing, but prior to curing, affect the tensile and modulus values obtained with natural rubber by as much as 25%. One year later the same committee (2) reported on the effects of moisture on abrasion resistance. Newton (3) found that the effect of moisture on the rate of cure of natural rubber depends on the pH. He has shown that below pH 6.5 the rate is slower with increased moisture content, and above 6.5 it is faster. More recently, several investigators (4-8) have studied the effects of moisture on the physical test results obtained with carbon black stocks of synthetic rubber.

In reviewing this work, one thing is clear. Moisture definitely affects the rate of cure. There appear to be some differences of opinion, however, regarding the exact relation among moisture, rate of cure, and the values of modulus and tensile strength attainable. These differences apparently arise for several reasons, but the primary ones seem to be due to the lack of a precise method for measuring the moisture content, inadequate control of factors which influence the results, and an insufficient amount of data. For instance, Fletcher (9) on the basis of strain data concluded that a natural rubber mercaptobenzothiazole-diphenyl guanidine stock or one accelerated with N-cyclohexyl-2-benzothiazole sulfenamide is relatively insensitive to the effects of moisture. In discussions with rubber technologists, comments made indicate that other investigators were unable to substantiate this opinion.

[1] A contribution from the U. S. Natural Rubber Research Station, Salinas, Calif., Bureau of Agricultural & Industrial Chemistry, United States Department of Agriculture.

[2] Present address, Scott Testers, Inc., Providence, R. I.

[3] Present address, North American Aviation, Inc., Los Angeles, Calif.

[4] Present address, W. J. Voit Rubber Corp., Los Angeles.

[5] Numbers in parentheses refer to Bibliography items at end of article.

In compounding studies on guayule rubber, reversals in the curing characteristics were encountered which appeared to be due to variation in moisture content. It was recognized that if this variable were to be eliminated from the testing procedure, a precise method for determining the amount of moisture in the compounded stock was essential. Consequently the method developed by Tryon (10) was adopted for the purpose, and a series of experiments was designed to show the exact relation between the curing characteristics of a compounded stock and the moisture content at the time of vulcanization.

Unfortunately the guayule rubber project under which this work was conducted was closed before all of the experiments were completed. However, the results obtained with the Mooney viscometer and also with the strain tester were so highly significant that it seems worthwhile to present them as a progress report with the hope that other investigators will adopt the method and carry out additional experiments on other rubbers and rubber compounds.

Methods of Test

Seven series of tests were made with two different samples of deresinated guayule rubber and one of No. 1 *Hevea* smoked sheet. These were compounded in three recipes, as shown in Table 1.

TABLE 1. TEST RECIPES

Recipe	A	B	A	A. C. S. No. 1
Guayule	100	100		
Hevea	—	—	100	100
Stearic acid	4.0	4.0	4.0	0.5
Zinc oxide	6.0	4.0	6.0	6.0
Benzothiazyl disulfide (MBTS)	1.0	1.0	1.0	—
Tetramethylthiuram disulfide (TMTD)	—	0.3	—	—
Mercaptobenzothiazole (MBT)	—	—	—	0.5
Sulfur	3.5	1.5	3.5	3.5

The tests made are summarized in Table 2. With the

exception of series 3 and 4, each sample tested was individually compounded. Each batch, consisting of 300 grams of rubber plus the compounding ingredients, was mixed on a 6- by 12-inch mill conforming to ASTM specifications (11). The temperature of the rolls was brought to an equilibrium value of 160° F. before the rubber was placed on the mill. Mixing was then carried out in accordance with a very rigid procedure adopted for use in the Salinas laboratory.

TABLE 2. SUMMARY OF TESTS

Series	Rubber	Recipe	No. of Samples Tested	Tests
1	Guayule #1	B	13	Moisture, Mooney cure
2	Guayule #1	A	14	Moisture, Mooney cure
3*	Guayule #1	B	16	Moisture, Mooney cure
4*†	Guayule #1	B	14	Moisture, Mooney cure
5	*Hevea*	A	19	Moisture, Mooney cure strain @ constant stress
6	*Hevea*	A, C, S, #1	14	Moisture, Mooney cure strain @ constant stress
7	Guayule #2	A	13	Moisture, Mooney cure strain @ constant stress

*Series 3 and 4 consisted of tests made on one large batch.
†Moisture adjustments were made on a 6- by 12-inch mill.

Series 3 and 4 were mixed in two 4,500-gram batches and then blended on a 12- by 13-inch laboratory mill at the rubber laboratory of the Mare Island Naval Yard, Valleja, Calif. The purpose of series 3 was to eliminate variations due to compounding error. As soon as sufficient samples had been taken for series 3, the remainder of the batch was entitled series 4 and used to study the effect of adjusting the moisture content while the rubber was on the mill. To increase the moisture content, 200-gram portions were placed on a cold 6- by 12-inch mill and varying amounts of water (from 1-15 cc.) were added to the different aliquots. To decrease the moisture content, 200-gram portions were milled at 180° F. for different times ranging from 3-9 minutes.

Except for series 4, the moisture content of each sample was adjusted by exposing it to a constant relative humidity. A range of relative humidities was obtained by using the materials shown in Table 3. Saturated solutions were maintained in all cases except with colloidal silica. The relative humidity containers were placed in a wooden cabinet with circulating air controlled at 20 ± 2° C. Samples for series 1 and 2 were conditioned in regular 250-millimeter-diameter desiccators. In order to get a complete sample in one desiccator it was necessary to cut the sample and stack the pieces on ¼-inch-mesh galvanized wire screens. This practice resulted in moisture variations throughout the sample, however, and thus made it difficult to obtain good correlations. For the remainder of the series, flat enameled pans approximately 14 by 10 by 3 inches deep were substituted for the desiccators. One-quarter-inch-mesh galvanized wire screen was supported about one inch above the solution, and the uncut batch of compounded rubber, ¼ inch thick, was placed on the screen. The pans were sealed with flat glass covers placed on sponge-rubber gaskets cemented to the edge of the pans.

TABLE 3. MATERIALS USED TO OBTAIN RELATIVE HUMIDITIES

Material	Formula	% Relative Humidity at 20° C.*
Calcium sulfate	$CaSO_4.5H_2O$	98
Oxalic acid	$H_2C_2O_4.2H_2O$	76
Sodium nitrite	$NaNO_2$	66
Sodium dichromate	$Na_2Cr_2O_7.2H_2O$	52
Potassium carbonate	$K_2CO_3.2H_2O$	43.8
Calcium chloride	$CaCl_2.6H_2O$	32.3
Potassium acetate	$KC_2H_3O_2$	20
Zinc chloride	$ZnCl_2.1\frac{1}{2}H_2O$	10
Colloidal silica	SiO_2	0†

*Values taken from "Handbook of Chemistry and Physics" (12) except colloidal silica.
†Estimated for dry material.

Ordinarily, the samples were tested seven days after being placed into the humidity vessel. This practice was not rigidly adhered to, however, because preliminary tests disclosed no variation in effect of moisture on the physical properties measured with length of exposure. Exposure times varying from 24 hours up to three weeks had no apparent effect on the moisture-cure charteristics relation found.

The samples were kept in the humidity vessels until they were to be cured. On the day a particular sample was to be tested, the press cures were run in such a way that they overlapped the moisture determination and the Mooney cure test. Five press cures were made, attempting to get a reasonable distribution of points with decided over and under cures. The portion used for each cure was removed from the vessel just prior to curing. All cures for strain tests were made in a standard four-cavity mold for test sheets at a press temperature of 275° F.

One 25-gram portion and one 50-gram portion were taken simultaneously for the Mooney cure test and for moisture determination, respectively. These tests were started as quickly as possible after removal from the vessel.

Moisture determinations were made in accordance with slight modifications of a method developed by Tryon (10) and improved for use in the synthetic rubber laboratories (13). In this method the moisture in the sample is distilled off with toluene, collected in a trap, then drawn into a calibrated capillary and measured. A diagram of the apparatus is shown in Figure 1. It was found that when the

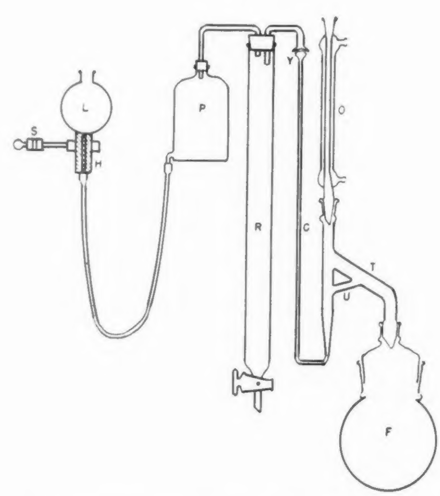


Fig. 1. Apparatus for Moisture Analysis by Distillation

F—Flask; T—Trap; U—Tubing for Overflow; O—Condenser; C—Capillary Tube; Y—Spherical Joint; R—Glass Tubing for Waste; P—Aspirator Bottle; S—Ring Stand Clamp with Threaded Block; H—Brass Pipe Threaded to Pass Freely through the Threaded Block in S; L—Leveling Bulb

toluene was dried by refluxing with a condenser and moisture trap set-up immediately prior to the test, more consistent results were obtained than if the toluene were dried with silica gel. The silica gel rapidly lost its drying capacity, and frequent blanks had to be run in order to insure against increasing error due to moisture in the toluene. Dry toluene can be reused several times before discarding as the presence of dissolved rubber does not interfere with moisture determination.

Two-pound kraft paper bags were used to hold the rubber specimens, and the bags were dried by refluxing with toluene immediately prior to a test. This was accom-

plished without loss of time by carrying out the drying operation in a separate wide-mouth two-liter flask, moisture trap, and condenser set-up. It was found that dry paper bags will pick up moisture even when stored under toluene because of the frequent opening of the container to remove a bag. Based on moisture determinations of eight compounded samples of 50 grams each, the standard deviation for the method was 0.016%.

The Mooney viscometer used was an electrically heated NBS model. It was brought to an equilibrium temperature (14) of 275° F. before the start of each test. A 25-gram specimen of the mixed stock was inserted into the machine as quickly as practicable, with care not to have the machine open any longer than necessary. Time was counted from the instant the machine was closed, and after a one-minute warm-up the motor was started. Viscosity readings were taken at half-minute intervals. The minimum temperature indicated by a Rubicon portable precision potentiometer was read usually about 10 seconds after the machine was closed, and thereafter temperature readings were taken simultaneously with the Mooney readings. The large rotor was used throughout the tests.

The temperature controls were similar to those described in the Symposium on Rubber Testing (15), and the temperature measurements were made in accordance with ASTM Method D1077-49T (14).

Owing to temperature variations, the correlation between moisture and scorch time (14) and moisture and rate of cure, as defined later, was improved considerably by correcting the Mooney cure curve to the test temperature in a manner similar to that of Shearer *et al.* (16). Based on the experience of Shearer, a temperature reaction coefficient of 2 was assumed for our use in arriving at a viscosity time curve corrected for temperature variation. The relations among temperature of reaction, time, and temperature reaction coefficient, for a specific reaction are shown by equation 1:

$$t_2 = t_1 K^{\frac{(T_1-T_2)}{10}} \qquad \text{Eq. 1}$$

where t_2 is the time required for the reaction at a temperature of T_2 degrees C., to reach the same state as would be reached in time t_1 at a reaction temperature of T_1 degrees C., and K is the temperature reaction coefficient.

By applying this equation to information such as that obtained from the typical temperature and Mooney curves shown in Figure 2, and transposing as indicated below, one can obtain the corrected Mooney curve, also shown in Figure 2. Proceeding in this manner equation 1 becomes

$$t_1 = \frac{1}{2^{\frac{(T_0-T)}{18}}} \qquad \text{Eq. 2}$$

where t_2 is set equal to one minute. K is set equal to 2. Temperatures are changed to Fahrenheit degrees; T_1 is made equal to T_0, and T_2 is replaced by T. From Figure 2, T_0 equals the test temperature (in this case 275° F.), T equals the temperature of the test specimen at the actual time t, and t_1 equals the effective time per minute, that is, the time at temperature T_0 (275° F.) required to effect the same amount of cure obtained in one minute at temperature T, and the total effective time t_n at the time t will be equation 3.

$$t_n = \sum_0^n t_1 = \sum_0^n \frac{1}{2^{\frac{(T_0-T)}{18}}} \qquad \text{Eq. 3}$$

The corrected curve in Figure 2 is obtained by plotting the Mooney value against the total effective time. For convenience, the total effective time was obtained from tables calculated to show the relation between T_0, T, t, and t_1. The scorch time, $(t_{mv}+5)$, was taken directly from the corrected viscosity curves.

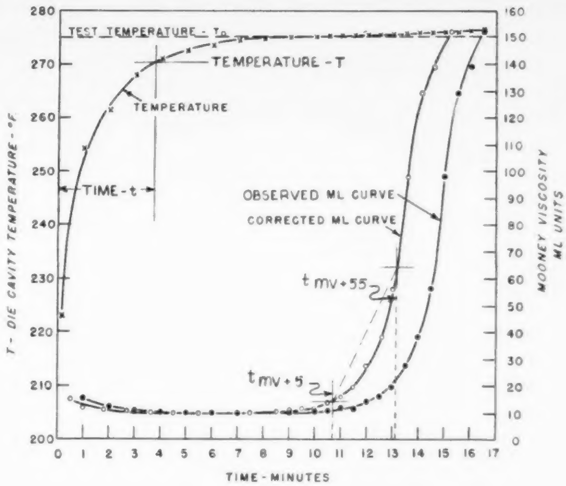


Fig. 2. Typical Mooney Cure Curves. T, the Temperature of the Specimen at Actual Time; t = Four Minutes; and $t_{mv}+5$, and $t_{mv}+55$, on the Corrected ML Curve Are Shown

The rate of cure calculated by a method similar to that suggested by Veith (17) is defined as the average increase in Mooney units per minute (U/M for an increase of 50 ML units above the $(t_{mv}+5)$ value. That is:

$$U/M = \frac{50}{(t_{mv}+55)-(t_{mv}+5)} \qquad \text{Eq. 4}$$

where $t_{mv}+5$ is the time corresponding to the minimum viscosity plus 5 units, and $t_{mv}+55$ is the time at which the viscosity has increased 55 ML units above minimum value.

Specimens for elongation measurements at a constant stress of 100 psi. were cut from the test sheets with a standard die and tested on an NBS strain tester in a constant-temperature room the day after they were cured. Three specimens were tested from each sheet, and the average of the three results was taken as the strain. The parameters for the rectangular hyperbola relating cure time and strain were then calculated in accordance with the method presented by Roth (18).

Discussion of Results

Typical results are presented in Figures 3 to 6 inclusive, and a statistical analysis of all of the data except that from series 1 and 2 is given in Table 4. Series 1 and 2 were not included because of non-uniformity of moisture content in the conditioned samples.

Figure 3 (plotted from series 3 data) clearly shows that for a single batch of MBTS, TMTD-accelerated, pure-gum stock of guayule rubber, excellent correlation is obtained between moisture content and both the scorch time $(t_{mv}+5)$ and rate of cure (U/M). Equally important to the correlation, however, is the extreme sensitivity. Reducing the moisture content from 1% to near zero results in the scorch time being almost doubled and the rate of cure being reduced approximately two-thirds. All compounding errors have been eliminated from this series, and the excellent precision of the method is therefore amply demonstrated.

Figure 4 shows the variation of scorch time with variation in moisture content for series 5, 6, and 7, and Figure 5 shows the variation in rates of cure for the same series. In comparing the data in Figure 3 with Fig-

TABLE 4. STATISTICAL ANALYSIS OF DATA SHOWING CORRELATION BETWEEN MOISTURE AND CURE CHARACTERISTICS

Test Series	Kind of Rubber	Recipe	Independent Variable	Dependent Variable Rate of Cure	No. of Observations	Correlation Coefficient*	Regression† Coefficient
3	Guayule	B	Moisture %	U/M	14‡	+0.99§	+14.1
4¶	Guayule	B	Moisture %	U/M	10	+0.94§	+14.7
5	*Hevea*	A	Moisture %	U/M	19	+0.93§	+32.3
6	*Hevea*	A. C. S. No. 1	Moisture %	U/M	14	+0.74§	+16.9
7	Guayule	A	Moisture %	U/M	13	+0.90§	+13.1
3	Guayule	A	Moisture %	$t_{mv}+5$	14	−0.99§	−7.4
4¶	Guayule	B	Moisture %	$t_{mv}+5$	10	−0.99§	−6.4
5	*Hevea*	A	Moisture %	$t_{mv}+5$	19	−0.90§	−15.1
6	*Hevea*	A. C. S. No. 1	Moisture %	$t_{mv}+5$	14	−0.87§	−5.8
7	Guayule	A	Moisture %	$t_{mv}+5$	13	−0.94§	−16.4
5	*Hevea*	A	Moisture %	t_o	14	−0.66§	−15.05
6	*Hevea*	A. C. S. No. 1	Moisture %	t_o	14	+0.06	——
7	Guayule	A	Moisture %	t_o	8	+0.58	——
5	*Hevea*	A	Moisture %	E_∞	14	+0.52	——
6	*Hevea*	A. C. S. No. 1	Moisture %	E_∞	14	−0.16	——
7	Guayule	A	Moisture %	E_∞	8	+0.10	——
5	*Hevea*	A	Moisture %	1/k	14	−0.52	——
6	*Hevea*	A. C. S. No. 1	Moisture %	1/k	14	−0.40	——
7	Guayule	A	Moisture %	1/k	8	−0.78‖	−2146

* The correlation coefficient is a measure of the tendency of one variable to change proportionately with a change in another variable. The correlation coefficient ranges from −1.000 to +1.000. (Perfect positive correlation = +1.000, and perfect negative correlation = −1.000. A correlation coefficient of 0 indicates a complete lack of influence of the action of one variable upon the action of the other variable.)

† The regression coefficient gives the magnitude of change in the dependent variable for each unit change in the independent variable.

‡ Disagreement between the number of observations in Table 4 and the number of samples tested in Table 2 is due to lack of complete data for all tests.

¶ Moisture content adjusted mechanically.

§ Correlation statistically highly significant, $P < 0.01$.

‖ Correlation statistically significant, $P < 0.05$.

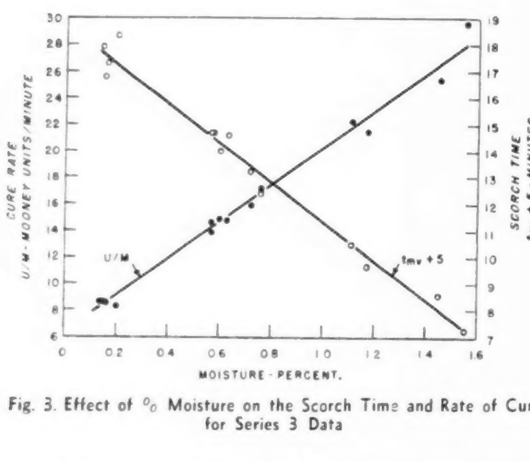


Fig. 3. Effect of % Moisture on the Scorch Time and Rate of Cure for Series 3 Data

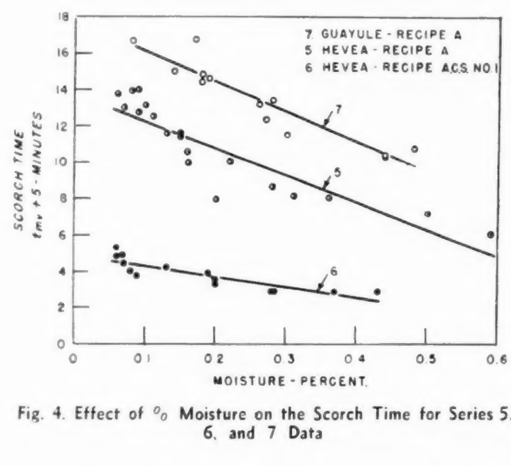


Fig. 4. Effect of % Moisture on the Scorch Time for Series 5, 6, and 7 Data

ures 4 and 5, it is immediately apparent not only that the correlation in the latter two is much poorer than that for the first, but also that the data might better be represented by curved lines. Because of the evidence in Figure 3, however, together with data on other stocks and the fact that each point shown in Figures 4 and 5 represents a separately compounded batch, and must therefore include not only compounding errors, but errors due to variation in the rubber as well, the authors did not feel justified in drawing anything but straight lines for the range of moisture investigated.

Bowell and Rush (19) have shown in stress-strain studies of GR-S that compounding errors amount to a large portion of the total error. The relatively poor correlation of series 6 may also be attributed to its faster curing characteristics at a test temperature of 275° F. Better results would be expected at some lower temperature. No attempt was made to blend the rubber before compounding although blending undoubtedly would have improved the results. It seemed more important, however, to determine whether or not the errors due to variations in the rubber and in the compounding procedures would be large enough to mask variations in the curing characteristics with variations in moisture. Since the correlation coefficients of variation of scorch time and cure rate with moisture are all 0.74 or above, we may conclude the method is highly significant, even with the errors mentioned above.

A statistical analysis of the data, summarized in Table 4, clearly shows that moisture content has a highly significant effect on both the scorch time and on the rate of cure of all of the compounds tested. Unfortunately, the correlation found for the parameters of the hyperbolic strain data (18) were not so good as expected. This fact may be attributed to three things: (1) use of decided over- and under-cure times; (2) an insufficient number of cures near the point of maximum curvature, and (3) selection of the curing temperature.

The correlation for all of the series 6 data undoubtedly would have been improved had a lower test temperature been used. Although quantitative correlation in terms of these parameters was disappointing, qualitative correlation between strain and moisture content shown in Figure 6 is unquestionably good.

In analyzing the data presented in this paper one should keep in mind the fact that the primary purpose underlying the work was to develop the optimum test recipe for guayule rubber, and that time did not permit continuing with the experiments which are obviously needed, as indicated by the results obtained. For instance, series 5 (#IRSS) compounded in recipe A, with 4.0 parts of stearic acid has no practical significance and was used only to give a direct comparison with guayule in a recipe suitable for guayule. Had time permitted, series 6 (#IRSS) compounded in the A.C.S. No. 1 recipe would have been repeated at a lower test temperature and additional cures would have been made in series 5, 6, and 7 for strain data. Also, for a complete picture, other accel-

erator combinations both for guayule and for *Hevea* would have been tried.

Conclusions

The curing characteristics of compounded rubber stocks and the stress strain properties, particularly for undercures, are highly sensitive to the moisture content. For precise testing, the moisture content must be taken into account. Precise conditioning of the rubber, compounding ingredients, the compounding laboratory, and the uncured stock might result in adequate control of this factor, but until such time as this point can be proved, it is strongly recommended that moisture content and the effect of moisture be determined for each recipe where precise evaluation is desired.

The method used in obtaining the data presented in this paper is relatively simple to follow once the necessary apparatus is assembled and, as has been shown, may be used to eliminate a testing variable which has long been recognized. Heretofore it has not been possible to eliminate the effect of moisture completely, because the technologist has not had facilities for proper conditioning or a method for precisely determining moisture content.

In all of the tests run at the Salinas laboratory the scorch time ($t_{mv}+5$) was found to decrease and the rate of cure (U/M) found to increase significantly with increase in moisture content. The authors definitely do not wish to imply that this rule can be applied to rubber compounds generally. In fact, ample evidence in the literature indicates that the opposite may be true for certain compounds, and there is some evidence (3) to indicate that a particular relation may be expected to hold only for a specific sample of rubber compounded in a specific recipe. It therefore appears necessary to determine the effect of moisture for each sample of compounded rubber stock if precise test results are to be obtained.

Acknowledgment

The authors wish to thank Eleanor Taylor and Ruth Crook for their valuable aid in making many of the necessary calculations and statistical analyses and for drawing the figures.

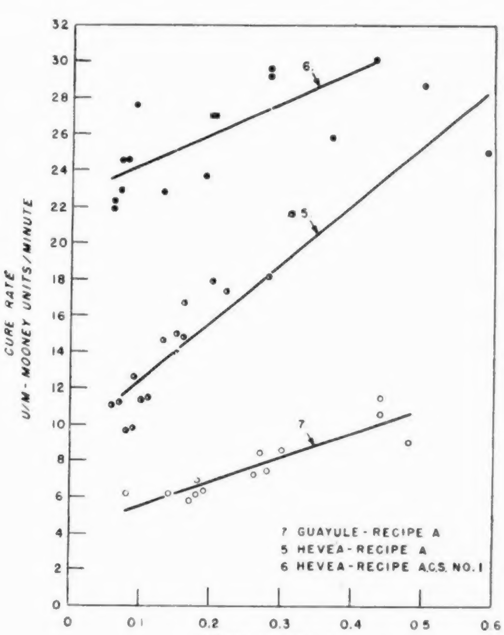


Fig. 5. Effect of % Moisture on the Rate of Cure for Series 5, 6, and 7 Data

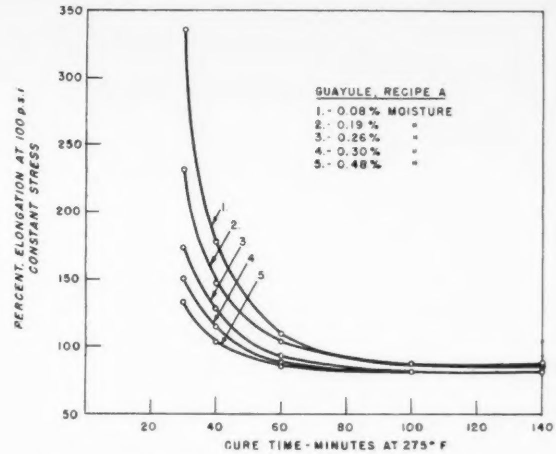


Fig. 6. Effect of % Moisture on the Strain for Series 7 Data

Bibliography

(1) "Importance of Temperature and Humidity Control in Rubber Testing." *Rubber Chem. Tech.*, 1, 182 (1928).

(2) "Importance of Temperature and Humidity Control in Rubber Testing, II. Resistance to Abrasion." *Ibid.*, 2, 680 (1929).

(3) "Curing Rate of Rubber, Effect of Phosphate Buffer Mixtures on Rate of Cure of Crepe Rubber." E. B. Newton, *Ibid.*, 15, 580 (1942).

(4) "Influence of Moisture Content of Carbon Black on Rubber Properties." L. H. Cohan, C. R. Johnson, *Ibid.*, 15, 216 (1942).

(5) "Effect of Moisture on Curing Rate of GR-S." H. A. Braendle, W. B. Wiegand, *Ibid.*, 18, 141 (1945).

(6) "Effect of Atmospheric Humidity on GR-S." F. E. Rupert, F. W. Gage, *Ind. Eng. Chem.*, 37, 378 (1945).

(7) "Effect of Moisture on GR-S Rate of Cure and Physical Properties." I. C. Rush, *Rubber Chem. Tech.*, 19, 773 (1946).

(8) "Effect of Moisture Variations on Curing Rate of GR-S." I. C. Rush, S. C. Kilbank. *Ibid.*, 22, 775 (1949).

(9) "Some Problems Involved in the Grading and Testing of Natural Rubber." W. P. Fletcher. *Ibid.*, 23, 107 (1950).

(10) "An Improved Apparatus for Determining Moisture in Rubber by Distillation with Toluene." M. Tryon, *Ibid.*, 25, 704 (1952).

(11) "Tentative Method of Sample Preparation for Physical Testing of Rubber Products." ASTM Designation D15-50T. "ASTM Standards on Rubber Products, 1951." American Society for Testing Materials, 1916 Race St., Philadelphia, Pa.

(12) Twenty-ninth edition, p. 1877. Chemical Rubber Publishing Co., Cleveland (1945).

(13) "Specifications for Government Synthetic Rubbers." Section C-1. Reconstruction Finance Corp., Office of Rubber Reserve, Washington, D. C. (Jan. 1, 1951).

(14) "Tentative Method of Test for Curing Characteristics of Vulcanizable Rubber Mixtures during Heating by the Shearing Disk Viscometer." ASTM Designation D-1077-49T. "ASTM Standards on Rubber Products, 1951."

(15) "Development and Standardization of Tests for Evaluating Processibility of Rubber." R. H. Taylor, J. H. Fielding, M. Mooney, *Rubber Age* (N. Y.), 61, 567 (1947).

(16) "Measurement of the Scorch and Cure Rate of Vulcanizable Mixtures, Using the Mooney Plastometer." R. Shearer, A. E. Juve, J. H. Musch, India Rubber World, 117, 216 (1947).

(17) "Technically Classified Rubber—The Non-Rubber Content and the Measurement of Cure Rate." A. G. Veith, ASTM Special Technical Pub. No. 136, p. 33 (1952).

(18) "Vulcanization Parameters from Strain Data." F. L. Roth. Report from the National Bureau of Standards to Office of Rubber Reserve (Feb. 20, 1950).

(19) "The Errors of Stress-Strain Testing." S. T. Bowell, I. C. Rush, *Rubber Age* (N. Y.), 72, 215 (1952).

Thiokol-Impregnated Leather Cup Packing

A NEW cup packing made from leather impregnated with Thiokol Liquid Polymer and claiming properties comparable to the resiliency of rubber and the toughness of leather is being marketed by E. F. Houghton & Co., Philadelphia, Pa. Designated Vim No. 1243-311, it performs well from 0-15,000 psi. and from −65 to 200° F., with tight seals obtained against oils, solvents, and gases.

Thiokol Liquid Polymer, a solventless liquid that converts to a rubber without shrinkage at room temperature, was used since it could impregnate the leather pores and provide the desired finished product properties.

Glossary of Terms Used in the Mechanical Rubber Goods Industry

THERE has been a long-felt need of a glossary of terms used in the mechanical rubber goods manufacturing industry. After more than a year of effort the Technical Committee of the Mechanical Rubber Goods Manufacturers Division of The Rubber Manufacturers Association, Inc., has compiled such a list of terms.

While this list cannot by any means be considered as definitive, it is undoubtedly a most comprehensive one and represents the combined experience of various branches of the entire industry. Suggestions as to additions, deletions, changes, etc., are most welcome and should be sent to The Rubber Manufacturers Association, Inc., 444 Madison Ave., New York 22, N. Y., attention of E. A. Foote, secretary of the Technical Committee-Mechanical Division.

A

Abraded: Worn away by friction.

Abrasion: Wearing away by friction.

Accelerated Life Test: (1) A laboratory test procedure which has been intensified to reduce the time of exposure to reach an end point. (2) Any set of test conditions designed to reproduce in a short time the deteriorating effect obtained under normal service conditions.

Accelerated Service Test: A service or bench test in which some service condition, such as speed, or temperature, or continuity of operation, is exaggerated in order to obtain a result in shorter time.

Acceleration Howl: An audible sound occurring when surface speed of a V-belt drive is suddenly changed.

Accordion-Folded: Folded alternately upward, and downward, producing a sinusoidal disposition of the fabric strip in the cross-section.

Acid Resistant: Withstands the action of acids.

Adapter: An end ring-shaped, on the side toward the packing, to conform to the shape of the packing—as for instance, convex V, concave V, etc.

Adhere: (1) To cling or stick together. (2) To cause to cling or stick together.

Adhesion: (1) Basically, the adhering, clinging, bonding, or sticking of two material surfaces to one another such as rubber to rubber, rubber to glass, rubber to metal, rubber to wood, rubber to fabric, rubber to cord, rubber to wire, etc. (2) Refers to the strength of bond between cured rubber surfaces or cured rubber surface and a non-rubber surface.

Adhesion Failure: (1) The separation of the two surfaces with a force less than specified. (2) The separation of the two adjoining surfaces due to service conditions.

Adhesion (Packing): A condition which develops in service or bench tests, under static conditions, wherein the packing grows fast to the rigid member.

Adhesive: A material which, when applied, will cause two surfaces in contact with each other to stick together.

Adhesive Coating: A surface layer applied to any product to increase its adherence to an adjoining surface.

Adhesive Fabric: A fabric with a surface treatment which will bond two surfaces together when it is interposed between the surfaces. Also may be used to adhere to only one surface, such as friction tape used in hose building.

Aging: To undergo changes in physical properties with age or lapse of time.

Aging, Air Oven: A means of accelerating the change in physical properties of rubber compounds by exposing them to the action of air at an elevated temperature.

Aging, Air-Pressure Heat: A means of accelerating the change in physical properties of rubber compounds by exposing them to the action of air under pressure at an elevated temperature. (See *Air Bomb*.)

Aging, Oxygen Bomb: A means of accelerating the change in physical properties of rubber compounds by exposing them to the action of oxygen at an elevated temperature and pressure.

Air Bomb: Similar to an oxygen bomb, but used with air. Used for accelerated aging test.

Air Checks: Surface markings or depressions due to trapping air between the material being cured and the mold or press surface.

Air Curing: The vulcanization of a rubber product in air, as distinguished from vulcanizing in a press or steam vulcanizer.

Air Locks: See *Air Checks*.

Air Marks: See *Air Checks*.

Air Shots: See *Air Checks*.

Air Spot: Surface unevenness due to volume of stock being insufficient to fill the mold cavity.

Air Trap: See *Air Checks*.

Align: To locate in a common line or common plane.

Alignment: (1) Position or place in line. (2) In V-belt drives, the condition of having all sheaves of each belt in the drive located so that the plane through center of each groove and at right angles to the axis, coincides with the similar planes through corresponding grooves in the other sheaves.

Ambient Temperature: The environment temperature surrounding the object under consideration.

Anchorage: Means of obtaining adhesion of rubber to rubber, rubber to fabric, rubber to metal, or rubber to other material.

Angle of Braid: The angle between any yarn, strand, or filament of the braid and a line parallel to the axis.

Angle of Lay: The angle developed at the intersection of a strand and a line parallel to the lineal axis.

Angle of Repose: The maximum angle from the horizontal of an inclined plane on which a body will not slide.

Angle, V-Belt: The angle formed at the intersection of the projection of the driving sides.

Angular Misalignment (Pipe): Difference between 180 degrees and the angle between the axis of one pipe to be joined and an intersecting line parallel to the axis of the other.

Anti-Extrusion Ring: A rigid or semi-rigid ring employed at one or both ends of a packing set, primarily to prevent extrusion into clearances.

Arc of Contact: (1) The portion of a curved surface which is engaged. (2) In belts, it refers to the portion of a pulley which is engaged by the belt and is usually expressed in degrees.

Arch (Expansion Joint): A convolution in the cylindrical wall.

Armor: A protective covering over a hose applied as a braid or spiral to prevent physical abuse.

Armored: See *Armor*.

Army Duck: A very closely woven duck with plied yarns in both warp and filler designated by ounces per running yard of a prescribed width.

Asbestos: A fibrous mineral from which fine fibers of appreciable length may be separated.

Asbestos Fiber: (1) (Scientific)—The sub-microscopic fibrous

element of one of the asbestiform minerals. (2) (Commercial)—Incompletely separated fiber bundles resulting from the processing of an asbestos mineral.

Atmospheric Cracking: Cracks produced in surface of rubber articles by exposure to atmospheric conditions.

Average Modulus: Total change of stress divided by total change of strain, i.e., the average slope of the stress-strain curve. Employed when modulus varies from point to point.

Axial Seal: A shaft seal in which the packing member approaches the surface to be sealed in an axial direction.

Axial Stress: Stress directed against, or by, a packing in the axial direction.

B

Back Flash: See *Back Rind.*

Back Flow: See *Back Rind.*

Back Follower (Cup): The piston, or portion thereof, to which a cup is bolted.

Back Rind: Distortion at the mold parting line, usually in the form of a ragged or torn indentation.

Backing: (1) A layer or liner of material on the underside of a sheeted product for mechanical reinforcement. (2) A soft rubber layer between tube and/or cover and carcass to provide adhesion.

Backing Plate (Cup): See *Back Follower.*

Back-up Plate (Cup): See *Back Follower.*

Bag Cure: A method of vulcanization wherein a flexible bag is used to impart positive pressure to the article being vulcanized.

Banbury Mixer: A specific type of internal mixer used to incorporate fillers and other ingredients.

Band: (1) In tires, two or more pieces of bias-cut rubber-coated cord or wire fabric, spliced endless, which form the plies that reinforce and shape the tire. (2) A metal ring which is welded, shrunk, or cast on the outer surface of a hose nipple. (3) A flat flexible strip of metal used on the outside of hose to bind the hose to the coupling, fitting, or nipple.

Band, Pinched: A deformation or contraction in a strip of rubberized cord or wire fabric distorting it from its normal plane.

Band, Torn: A cut or tear in a strip of rubberized cord or wire fabric.

Band, Wrinkled: A ridge, furrow, or crease in a strip of rubberized cord or wire fabric.

Bare Back: The textile face of an article which is free of any treatment or covering.

Bare Duck: The duck surface of a fabricated article wherein the exposed duck surface is free of treatment or covering.

Bare Duck Belt: A belt in which at least one side has the exposed duck surface free of any covering.

Base Diameter: See *Heel Diameter.*

Base Gum: The rubber compound forming the narrower trapezoidal portion of a V-belt adjacent to, but below the tension member.

Base of Thread: The surface from which the thread projects.

Base Thickness (Cup, Hat Packing, or U-Packing): Axial dimension of base.

Beading: Material used as a filler in a seam.

Beater-Process Paper: Paper in which most or all of the binder (generally rubber) is added to the fibers before the sheet is formed on a paper machine.

Bellows: See *Cylindrical Diaphragm.*

Belt Duck: An open-weave duck made from plied yarns with strength predominately in the warp direction, and used primarily in the manufacture of belts.

Belt Fastener: A device for holding the ends of belt together.

Bench Test: A modified service test in which the service conditions are approximated, but the equipment is conventional laboratory equipment and not necessarily identical with that in which the product will be employed.

Bend: (1) To bring into a curve, or out of a straight line. (2) The bend of a hose from a straight line expressed in degrees per foot of length or in radius of bend.

Bending Modulus: Force required to induce bending around a given radius; hence, a measure of stiffness.

Bevel End (Packing Set): A convex or concave conical face on one end ring. Bevel angle, where given, is the base angle of the cone.

Bevel Joint (Packing Ring): A cut along a plane inclined to the axis, but intersecting it in the center of the ring. Bevel angle, where given, is to the face of the ring.

Bias Cord Breaker: Cord breaker fabric cut on a bias angle.

Bias Cut: A cut of a textile material made diagonally at an angle less than 90 degrees with the direction of the warp threads.

Bias Laid: Material laid on or wrapped around so that the threads are at an angle of less than 90 degrees to the longitudinal axis.

Bias Seam: A seam in which the material to be joined is cut on a diagonal.

Binder: The component of any non-homogeneous rubber product that holds it together, i. e., rubber component of asbestos sheet packing.

Bite: The nip of a pair of rolls revolving toward each other, as in a mill or calender.

Bleed Connection: A connection to a lantern ring within a set, or to the space between two packings, to bleed away leakage.

Bleeding: Migration to the surface of plasticizers, waxes, or similar materials to form a film or beads. Also see *Bloom.*

Blemish: A mark, deformity, or injury which impairs the appearance.

Blisters: A raised spot on the surface, or a separation between layers usually forming a void or air filled space in the vulcanized article. (See *Bubbles, Sinks,* and *Voids.*)

Block End: A layer or layers of rubber or reinforcing materials in the end build-up of a hose used to satisfy dimension requirements.

Block Sides (Blocked Sides or Side Irons): Belts or rubber sheet cured between side bars of metal or other rigid materials for pressure and dimensional control.

Bloom: A discoloration or change in appearance of the surface of a rubber product caused by the migration of a liquid or solid to the surface. Examples: sulfur bloom, wax bloom. Not to be confused with dust on the surface from external sources.

Blow: (1) A soft area caused by porosity below the surface. (2) The volume expansion during the forming of sponge rubber expressed in per cent.

Blow-up: (1) A blister between plies of an article. (2) The inflation of hose or tubing prior to vulcanization.

Blue Asbestos: See *Crocidolite.*

Blush: See *Bloom.*

Body Ring (Expansion Joint): A reinforcing ring, generally of metal, in the carcass to increase ability to support pressure.

Bolt Circle: Circle passing through center of bolt holes. (See *Bolt Hole Circle.*)

Bolt Hole Circle: That perimeter along which the center of bolt holes in a flange face are distributed. (Pertinent information is the diameter of the bolt circle and the number and the size of the bolt holes.)

Bond: See *Adhesion.*

Boot: A diaphragm generally of the bellows type, employed at little or no pressure differential to exclude moisture, dirt, etc., from a concentric joint.

Bootlegging: (1) Progressive ply delamination. (2) The separation of plies in belting due to flexing.

Bore: A fluid passageway.

Bottom Cover: The protective rubber cover on the surface contacting the driving mechanism of a conveyor belt. (Also referred to as *Pulley Cover.*)

Bow: (1) Curvature from flat plane in the surface. (2) The deviation from the straight line of the fill yarn in a fabric. (3) The deviation from a straight line of a product when unrolled and laid on a flat surface.

Bowl: The exterior shell of an expansion ring coupling into which the hose or conduit is inserted.

Braid: A hollow or solid structure of round or polygonal cross-

section, produced by interlocking yarn strands or filaments which are disposed in direction oblique to the axis of the braid.

Braid, Angle of: See *Angle of Braid.*

Braid Photographing: The bas-relief or outline of the braid showing on the cover of braided hose after vulcanization. Most prominent when cover thickness is thin.

Braid, Wire. See *Wire Braid.*

Braided Hose: Hose in which the reinforcing material has been applied by braiding.

Braided Ply: A ply of braided reinforcement.

Braided Smash: A defect in the braided reinforcement caused by one or more of the ends of reinforcing material breaking during the braiding operations.

Braider: A machine for making braid. The yarn is drawn off of several bobbins while they move in and out during their travel around the center of the machine. These yarns are thus intertwined in a regular manner according to the desired pattern.

Braid-Over-Braid: A braid made by more than one pass through a multiple-carrier braider.

Brand: A label identifying the product and/or manufacturer. The label may be embossed, inlaid, or printed.

Brand Marks: The mark or marks used to establish the identity of the product.

Break: A separation or discontinuity in any part of an article.

Break Through: A break in the surface caused by an internal stress and/or failure.

Break-Away Friction: Same as *Breakout Friction.*

Breakout (Packing): Force to inaugurate sliding. Expressed in same terms as friction. An excessive breakout value is taken as an indication of the development of adhesion.

Breakout Friction (Packing): See *Breakout (Packing).*

Brittle: Easily broken or snapped when bent or deformed.

Brownian Movement: A ceaseless, erratic motion of the suspended particles in colloidal solutions. The movement is the result of the impact with the molecules of the surrounding medium.

Brush Finish: The finish on a sand-cast fitting obtained by wire brushing.

Bubbles: Usually referring to surface blisters. (See *Blisters.*)

Bucket Cover: The cover of an elevator belt next to the carrying buckets. (See *Top Cover.*)

Buffing: To grind the surface, producing a roughened or a velvety surface. Usually done to produce dimensional conformance.

Buffing Marks: See *Buffing*—results of buffing operation.

Bulge: A protuberant deformation due to application of a force or load.

Butt Joint (Packing Ring): A cut along a plane passing through the axis.

Butt Seam: A seam made by placing the two pieces to be joined edge to edge.

C

C.B.S. (Cloth Both Sides): A common abbreviation used to describe a sheet, consisting of a ply of fabric or cloth on each surface with a sandwich of rubber between them.

C.B.S. Sheet: Similar to C. I. sheet except that two fabric plies are exposed on the surfaces, generally not frictioned on the exposed sides. (See *C.B.S.*)

C. I. Cloth Inserted: An abbreviation used to indicate a sheet of rubber containing one or more plies of cloth or duck, in which the cloth is completely covered with rubber.

C. I. Sheet: See *C. I. Cloth Inserted.*

C.O.S. (Cloth One Side): A common abbreviation used to describe a ply of fabric with a skim or sheet of rubber on one side of it.

C.O.S. Sheet: Similar to C. I. sheet except that one fabric ply is exposed at the surface, generally not frictioned on the exposed side.

Cable Cord: Cord, made from cable-twist yarn.

Cable Lay: Same as spiral lay, in which the reinforcement consists of multiple strands.

Cable Twist: A cord or rope construction in which each successive twist is in the opposite direction to the preceding twist, i.e., S-Z-S, Z-S-Z.

Cabled Yarn: A yarn made by twisting together two or more ply yarns. They may be made with cable or hawser twist.

Calender Stop: Mark left on the surface of rubber sheet or sheeting due to interruption of calender roll motion.

Canadian Asbestos: See *Chrysotile.*

Capped Edge: A rubber protective edge placed around a product internally reinforced with textile or other material.

Capped Ends: A seal on the end of a product to protect internal elements.

Carcass: The fabric, cord, and/or metal reinforcing section of any rubber product such as belt or hose, as distinguished from the rubber tube or rubber cover. (Also see *Ply and Reinforcement.*)

Carry Side Cover: See *Top Cover.*

Cemented Edge: An application of cement around the edge of a fabricated product with or without internal reinforcement for protection or adhesion. (A form of *Capped Edge.*)

Cemented End: A capped end accomplished by means of cement.

Center Yarn: A straight yarn introduced into the center of a solid braid, to increase the cross-section.

Centering Ring: An extension of a gasket for the purpose of locating it centrally on a flange.

Center-Packed: A variety of outside-packed in which the plunger enters fluid space at both ends.

Centrifugal Force: That force which tends to impel a thing, or parts of a thing, outward from a center of rotation.

Centripetal Force: Force exerted against a body whereby it is compelled to move in a circular arc.

Chafer: A duck of approximately square-woven construction made with single or ply yarn warp and filling.

Chafer Duck: See *Chafer.*

Chalking: Formation of a powdery surface condition due to disintegration of surface binder or elastomer due to weathering or other destructive environments.

Chamfer: To remove a sharp edge either by beveling or rounding.

Channel Gasket: A gasket of channel cross-section.

Charge Mark: The mold mark in a lead-press hose cover caused by the stopping of the lead press to add another lead billet to the press.

Checking: Short shallow cracks on the surface generally due to effect of destructive action of environmental conditions.

Chirp: Intermittent squeak of a V-belt operating in sheaves.

Chord Modulus: A modulus calculated from the slope of the chord of a stress-strain curve, connecting one point on the curve with the origin. This term is not in general use.

Chrysotile: A fibrous magnesium silicate, the most important asbestos mineral used for the preparation of yarns and compressed asbestos sheet.

Churn: (1) A vessel in which rubber compounds are stirred into solvents. (2) To stir or mix.

Cider Cloth: A square-woven, open-mesh fabric, made from coarse ply yarns.

Circulation Connection: A sealing connection in which part of the sealing fluid returns via a second port. Designed both to seal and cool.

Cloth-Both-Sides Sheet: See *C.B.S. Sheet.*

Cloth Impression: See *Fabric Impression.*

Cloth Insertion Sheet: See *C.I. Cloth Inserted.*

Cloth-One-Side Sheet: See *C.O.S.* and *C.O.S. Sheet.*

Coat: A layer of material covering surface.

Coefficient of Thermal Expansion: Average expansion per degree over a stated temperature range, expressed in a fraction of initial dimension. May be linear or volumetric.

Cog: A tooth on the rim of a wheel or rubber product.

Cogged V-Belt: A V-belt cut or produced with a series of evenly spaced V-shaped indentations in the inner face. (See *Notch.*)

Cold Check: A split, crack, fissure, or interruption of smoothness in calendered sheets caused by improper warming of the stock or temperature of rolls.

Cold Flex: Act or instance of bending or bowing a rubber product under conditions of cold environment.

Cold Flexibility: Flexibility following exposure to a predetermined low temperature for a predetermined time.

Cold Flow: Continued deformation under stress. (See *Creep* and *Drift.*)

Cold Resistant: Withstands the effect of cold or low temperatures without loss of serviceability.

Commercially Smooth: Degree of smoothness of the surface of an article which is acceptable for use.

Compounder's Modulus: A stiffness measurement extensively used by rubber technologists and is expressed as "modulus at 300%" or "300% modulus" (any other % elongation may be indicated, but 300% is very commonly used). By this is meant the tensile stress at the indicated elongation.

Compressed Asbestos Sheet: A sheet prepared from a rubber compound containing a high percentage of asbestos fiber, and volatile solvent, by the use of a special calender (sheeter) in such a manner that the solvent is volatilized, and the compound is caused to build up as an oriented sheet on one roll of the sheeter.

Compressibility: The property of exhibiting compression under load. In case of sheet material the % loss of thickness when subjected to a given load applied by a disk of given diameter for a predetermined short time and at a predetermined temperature, as defined in ASTM D-1147.

Compressible (Gasket): Exhibiting compression under stress. Sometimes limited to products which exhibit volume compression —thus, rubber products containing no voids said to be "incompressible."

Compression (Gasket): Reduction in one dimension as the result of application of stress. May or may not be accomplished by increase in other dimensions.

Compression Modulus: The ratio of the compressive stress to the resulting compressive strain (the latter expressed as a fraction of the original height or thickness in the direction of the force). Compression modulus may be either static or dynamic.

Compression Set: The deformation which remains in rubber after it has been subjected to and released from a specific compressive stress for a definite period of time at a prescribed temperature. Compression set measurements are for the purpose of evaluating creep and stress relaxation properties of rubber.

Concavity Factor: Rubber has no elastic limit, and the entire stress-strain curve is concave toward the stress axis or away from the strain axis. The relative amount that rubber varies from the Hookes' Law ideal curve is known as "concavity factor" determined as the ratio between the energy of the extension curve to the straight line curve to the same point. It may be expressed as:

$$\frac{\text{Proof resilience}}{1/2 \text{ Tensile product}}$$

Concentric Joint: A joint between concentric cylindrical members.

Condenser Ferrule: A tube sheet ferrule used in a surface condenser.

Conductive: A rubber having qualities of conducting or transmitting heat or electricity. Most generally applied to rubber products used to conduct static electricity. (See *Conductivity.*)

Conductivity: Quality or power of conducting, or transmitting heat or electricity.

Cone: A sliding packing, convex-conical on one face and concave-conical on the other; operating against any inner reciprocating or rotating member. Used alone or in sets.

Conformity Coefficient: See *"M" Value.*

Conformity (Gasket): Degree, or accuracy, of fit between gasket surface and surface of rigid member.

Contact-Pressure Ratio: See *"M" Value.*

Contact Stain: When staining occurs on the area of an object directly in contact with the rubber article, it is known as "contact stain."

Contraction: Opposite to elongation or to expansion.

Control: A product of known characteristics which is included in a series of similar service, or bench, tests to provide a basis for evaluation of one or more unknown products.

Conveyor Cover: Term applied to the protective covering of conveyor belts. Generally a rubber covering applied during manufacture as a separate sheet to form a continuous integral covering.

Cord: The product formed by twisting together two or more plied yarns.

Cord Breaker: Openly spaced cord fabric performing the same function as a leno breaker or cider cloth.

Core. (1) A strip, or assemblage of strips, of any material introduced into the center of a solid braid. (2) The portion of a mold which forms the interior of a hollow article.

Core Cut: Cut resulting from burr, nick, or rough edge on mold core. Usually occurring during removal of core.

Corkboard: Cork granules treated with a binder, compressed and sliced into sheets of desired thickness.

Cork-Composition Gasketing: Cork granules treated with a binder and sliced into sheet of desired thickness.

Corner-Yarn: A straight yarn introduced into an 8-carrier or multiple-carrier braid to impart or intensify a square cross-section.

Corrosion-Inhibiting (Packing): A property of packing whereby it actively inhibits corrosion of adjacent metal faces.

Corrosion (Packing): Corrosion of rigid member (usually metal) where it contacts packing. The actual corroding agent is fluid medium trapped in the interface.

Corrosive (Packing): A property of packing whereby it is assumed, often incorrectly, to promote corrosion of the rigid member by the trapped fluid.

Corrugated Cover: See *Lead-Press Corrugated.*

Count (Fabric): The number of warp ends, of filler picks, or both, in a square inch of fabric.

Coupled Lengths: Individual lengths of conduit or hose with couplings attached. This may be, as specified, either the length of exposed hose or the overall length including couplings.

Coupling: A device attached to the end of hose or conduit to facilitate connection to a suitable fitting and insure a passageway.

Coupling (Female): That portion of a coupling carrying the internal thread.

Coupling (Male): That portion of a coupling carrying the external thread.

Cover: Outer covering usually intended as protective coating.

Cover Lap: (1) The amount that a calendered cover extends over the starting edge. (2) Also see *Cover Push-Backs.*

Cover Push-Backs: A wrinkle, lap, or fold-over produced circumferential in the cover resulting from act of applying cover.

Cover Seam: Mark or line resulting from applying cover from calendered stock.

Cover Splice: Mark, line, or overlap resulting from the joining of two sections of calendered stock showing in the transverse direction.

Cover Wear: The result of use, showing consumption or impairment due to use.

Cracking: A sharp break or fissure in the surface. Generally due to excessive strain.

Crazing: A surface effect on rubber articles characterized by multitudinous minute cracks.

Creaming: The tendency in latex of rubber particles to rise like cream to the surface, leaving a higher proportion of serum in the lower layers.

Crease: A wrinkle or fold.

Creep: (1) The deformation occurring with the lapse of time, in both cured and uncured rubber, in a body under stress in addition to the immediate elastic deformation. Some related terms and properties are stress-relaxation, hysteresis, damping, flow, compression set, and viscosity. (See *Cold Flow* and *Drift.*) (2) In belts, the action of a belt alternately losing speed on the driving pulley and gaining speed on the driven pulley.

Creep-Relaxation (Flange Gasket): The type of relaxation encountered in bolted flange joints, i.e., loss of stress accompanied by constantly decreasing compressed thickness.

Crest of Thread: The outermost section of the thread.

Crimp: (1) The waviness of the yarn in a woven fabric. (2) The difference in distance between two points on a yarn as it lies in a fabric and the same two points when the yarn has been removed and straightened. Expressed as a percentage of the distance between the two points as the yarn lies in the fabric.

Crocidolite: A fibrous iron silicate—used for same purposes as Chrysotile where resistance to mineral acids is desired.

Crocking: A migration or blooming to the surface of pigments or fillers contained in a rubber compound.

Cross Expansion Packing: A form of slab packing in which most of the fabric plies are at an angle of 45 degrees to the surface.

Cross-Bar Gasket: A tube sheet gasket consisting, in addition to the rim, of one or more strips crossing the central area and serving to insulate some tube outlets from others.

Cross Wrap: Multiple layers of narrow tensioned wrapper spiralled circumferentially over the outside to apply external pressure during vulcanization. (See *Wrapped Cure.*)

Crystallization: A change in physical properties resulting from the crystalline reorientation caused by temperature.

Cure: The act of vulcanization.

Cure, Lead-Press: See *Lead-Press Cure.*

Cure Time: The time required to produce vulcanization at a given temperature. The cure time varies widely, being dependent on the type of compounding used, the thickness of the product, etc.

Curing Temperature: The temperature at which the rubber product is vulcanized.

Cushion Breaker: Leno or cord breaker embedded in a layer of pure gum rubber.

Cut: The number of 100-yard lengths in a pound. Employed to describe the weight of asbestos yarn.

Cut (Asbestos Yarn): See *Cut.*

Cut Open (Packing Ring): Cut from coil or spiral, or, if initially endless, cut open with one or more joints.

Cut Thread: (1) A thread produced by a lathe, screw-machine, or similar equipment, by the actual cutting out, or removal of metal. (2) A narrow strand of rubber produced by cutting.

Cutting Resistant: Withstands the cutting action of sharp objects.

Cylinder: The outer member with which a piston makes close fitting contact.

Cylindrical Diaphragm: A diaphragm in the shape of a cylinder, generally with one or more convolutions in the wall.

D

Damping: (1) The progressive reduction of amplitude in free vibration. (2) The friction of any kind in a free vibration system causing the motion to decrease gradually to the vanishing point.

Date Code: Any combination of numbers, letters, symbols, or other methods used by a manufacturer to identify the period of manufacture of the product.

Deformation: Any change of form or shape produced in a body by a stress.

Denier: A unit of yarn number. The number of unit weights of 0.05-gram per 450-meter length. A yarn numbering system based on denier units. Denier is equal numerically to the number of grams per 9,000 meters.

Density: The ratio of the mass of a body to its volume, or the mass per unit volume of the substance. For ordinary practical purposes, density and specific gravity may be regarded as equivalent.

Depression: A place or part that is depressed, a hollow.

Depth of Thread: The distance between the crest and the base of the thread, measured normal to the axis.

Depth (Packing Ring or Set): Axial dimension.

Diagonal Ring: A pair of mating packing rings, one of which has one face convex-conical, and the other has one face concave-conical.

Diameter: The length of a straight line passing through the geometric center to the periphery of an object.

Diameter, Effective Outside: The mean diameter calculated from the circumferential measurements of an irregular cylindrical product.

Diameter, Inside: The length of a straight line through the geometric center and terminating at the inner periphery of a cored object.

Diameter, Maximum: The greatest admissible diameter in a given case.

Diameter, Minimum: The least admissible diameter in a given case.

Diameter, Outside: See *Diameter.*

Diaphragm Packing: A packing between rigid members in relative motion which is attached to both members and absorbs the motion through its own deformation.

Diaphragm Sheet: Sheet (generally fabric-reinforced rubber) from which flat diaphragms may be cut.

Die Cut: (1) Shaped articles punched from a sheet of rubber with a die. (2) In extruded goods, a cut in the surface which may be intentional or a defect.

Die-Formed: Shaped in a forming die, generally without heat.

Die-Formed Spiral: A packing helix compressed to form a sleeve. Although sometimes referred to as "solid," corresponds in fact to a ring with a very shallow bevel joint making one or more complete turns.

Dielectric: The electrical potential strength or non-conducting properties of a rubber product. (See *Dielectric Strength.*)

Dielectric Strength: The measure of electric potential strength of a rubber product. Measure of its ability as an insulating compound to resist passage of a disruptive discharge, produced by an electric stress. Measured as volts per mil of thickness.

Differential Diaphragm: A diaphragm between two fluids at substantially different pressures.

Diffusion: (1) Commonly used to express the flow or loss of a gas under pressure through a rubber layer. (See *Effusion.*) (2) The striking through as in "frictioning."

Diluent. A diluting agent. Any liquid or solid which, when added to another liquid or solid, reduces the quantity per unit volume of the base material in the final total volume.

Di-Mer: A polymer whose molecule is believed to consist of only two molecules of the monomer.

Dip Coat: A thin coat on a surface obtained by dipping the material to be coated into the coating material.

Dipped Fabric: Coated with rubber compound by passing through a rubber solution and drying.

Dished: A depressed surface distortion of a flat or curved section of a rubber product.

Dished Diaphragm: A molded diaphragm in which the entire center is depressed below the plane of the rim. Designed to permit longer travel than a flat diaphragm of same diameter.

Disk Holder: The metal disk of a poppet valve when designed to accommodate a rubber valve disk.

Disk-Retainer: A washer used to clamp a rubber valve disk to the disk holder.

Dispersion: A heterogeneous system consisting of a continuous phase and one or more discontinuous phases.

Domed: A raised surface distortion of a flat or curved section of a rubber product.

Dog Ears: See *Horseshoe.*

Dog Leg: (1) A bending from a straight line. (2) A bend from a straight line in a vertical braided hose caused by the stopping-starting of the lead press to insert a billet of lead. (See *Charge Mark.*) (3) A bend from a straight line in a V-belt caused by the press laps.

Double-Acting Piston: A piston with fluid on both sides.

Double-Filling Duck: A type of flat duck with a plied yarn filling.

Doughnut Ring: See *O-Ring.*

Drift: (1) Continued deformation under strain. (2) The change in a given durometer reading after a period of time.

Drop Ply: (1) The omission of a reinforcing ply for a specified

distance from each edge. Usually the bottom or next to bottom ply in flat conveyor belting. (2) The dropping of a ply in a multi-ply cord.

Dry: (1) Absence of tack; no adhering properties. (2) To remove moisture.

Duck: A term applied to a wide range of medium and heavy-weight fabrics, commonly made of cotton, including the heaviest and strongest of all single-woven fabrics. There are three main types: number duck, army-type duck, and flat duck. The first two are always plain woven from ply yarns in warp and filling; the latter is plain woven with two single ends weaving as one and with either single or ply filling. Army-type ducks, as compared with number ducks, have a lighter thread count, finer yarns, and generally are lighter in weight. The yarns are usually coarse numbers, and there may be up to 14 or more combined in making the ply yarns. Most ducks are very compactly woven and firm in texture, but others are soft and pliable. Duck is also known as canvas, and many special names are used, e.g., belt duck, shoe duck, hose duck, harvester duck.

Duck and Rubber Packings: See *Slab Packing.*

Duck on Edge: Exposed threads of a carcass ply or breaker fabric through the cover edge of a rubber covered belt.

Durometer: An instrument for measuring the hardness of rubber. Measures the resistance to the penetration of an indentor point into the surface of rubber.

Durometer Hardness: An arbitrary numerical value which measures the resistance to penetration of the indentor point of the durometer. Value may be taken immediately or after a very short specified time.

Dynamic Modulus: The ratio of stress to strain under vibratory conditions. It is calculated from data obtained from either free or forced vibration tests, in shear, compression, or elongation. It is usually expressed in psi. for unit strain.

Dynamic Packing: See *Sliding Packing.*

Dynamic Resilience: The percentage of the vibrational energy which persists in the second of two successive free vibrations; also called *Vibrational Resilience.*

Dynamic Seal: *See Sliding Seal.*

E

Ears: Folds in the surface found prior to vulcanization that are not properly adhered.

Eccentric: (1) (General)—Off center. (2) (Packing)—Having an axis not coincident with the axis of the moving member.

Eccentric Wall: In hose or tubing, a condition where the wall gage of a specific cross-section is substantially non-uniform.

Eccentricity: In hose, tubing, or cylindrical articles when inside and outside diameters deviate from a common center. (Also see *Eccentric Wall* and *Off Center.*)

Eccentricity (Packing): Radial distance between axis and that of the moving member.

Effective Diameter (Diaphragm): A diameter corresponding to that of a packed piston which would give the same thrust at the same fluid pressure. Generally assumed as midway between outside and inside working diameters.

Effective Length: The length of a belt under operating tensions.

Effusion: (1) The flow through a porous diaphragm. (2) The flow of a gas under pressure through a rubber tube or layer. (See *Diffusion.*)

Eight (8) Carrier Braid: A solid braid constructed on a May-pole braider with 8 carriers, giving a square cross-section.

Elastic Limit: (1) The greatest stress which a material is capable of development without a permanent deformation remaining upon complete release of the stress. (2) In rubber, the elastic limit, as above defined, is very low and sometimes practically non-existent. Usually this term is replaced by various load limits for specific cases in which the resulting permanent deformations are not zero, but are negligible. (See *Yield Point.*)

Elastic Modulus: See *Modulus.*

Elasticity: The property of an article which tends to return it to its original shape after deformation.

Elastomer: An elastic rubber-like substance, such as natural or synthetic rubber.

Elongation: Increase in length expressed numerically as a fraction or percentage of initial length.

Embossing: Operation of transferring a design to a rubber or rubber-like surface.

Enameling Duck: An extra-wide flat duck.

End: One of several parallel yarns delivered by a single braider spool.

End Block: See *End Reinforcement.*

End Build: See *Block End.*

End Reinforcement: A layer of reinforcing material applied to the end to provide additional strength.

End Ring: Ring at one end of a packing set—generally an anti-extrusion ring.

Endurance Life Test: A laboratory procedure used to determine effective life of a rubber article when exposed to dynamic forces.

Endurance Test: Service or bench test, conducted to failure.

Enlarged End: An end with inside diameter greater than that of the main body.

Expander Spring: A radial spring employed to drive a piston ring outward against the cylinder wall—frequently of the wave type.

Expansion: The increase in any linear dimension, or in volume.

Expansion, Cubical: (1) The volumetric expansion of a body due to temperature or pressure. (2) Of hose, is measured by locking a liquid at a specified pressure in the hose and then releasing the pressure at one end so that the liquid may rise in a burette as it resumes its normal size. Generally given as cubic centimeters per unit of length.

Expansion Joint (Rubber): A flex unit employed in a more rigid conduit to absorb motion, vibration, and to correct initial misalignment.

Expansion Ring Coupling: A coupling in which the hose is compressed against an exterior shell by expanding a cylindrical ring of ductile material placed in the bore of the hose.

Exposed Fabric: On hose where spots of fabric reinforcement show owing to lack of cover, cap, or seal end. (See *Duck on Edge.*)

Extended Heel Diameter: (Cup, hat packing, U-packing with curved corner)—Diameter of line of intersection of extended working face with the plane of the base.

Extension Modulus: See *Tension Modulus.*

Extraction (As Applied to Rubber): The separation of certain components from a solid by the process of dissolving them in a liquid solvent under suitable conditions.

Extruded: Forced through die of tubing machine, in either solid or hollow cross-section.

Extrusion Mark: An elevated or depressed line on the surface of extruded items caused by imperfect dies or coarse particles lodged behind the die.

Extrusion (Packing): Escape of packing through clearances.

F

Fabric Braided: A fabric woven on a braider.

Fabric Ends/Inch: The number of warp or filler threads per inch.

Fabric Impression (Sheet or Sleeve): Marked with the imprint of fabric used as a wrapper during vulcanization.

Fabric Knitted: A flat or tubular structure made from one or more yarns or filaments whose direction is generally transverse to the fabric axis, but whose successive passes are united by a series of interlocking loops.

Fabric Picks/Inch: The number of small yarns per inch running from edge to edge of cord fabric to hold the cords in place.

Fabric Slab: Thick sheet composed entirely, or almost entirely, of superimposed layers of rubberized fabric—generally bias cut.

Fabric (Textile): A planar structure produced by interlacing yarns, fibers, or filaments. (See *Fabric Braided, Knitted,* and *Woven.*)

Fabric Woven: A flat or tubular structure composed of two

series of interlacing yarns or filaments, one parallel to the axis of the fabric, and the other transverse.

Face Seal: See *Axial Seal.*

Fatigue: The weakening or deterioration of a material caused by a repetition of stress or strain.

Feathered Edge: A wrapper cloth whose starting edge has had several warp threads removed.

Felt: A fiber mat produced by carding or other dry process.

Felt Gasketing: Felt, usually treated, intended for gasketing uses.

Ferrule: A metallic ring placed over the hose end, serving to attach the coupling to the hose. The ferrule may be crimped, forcing the hose in against the shank, or the shank may be expanded, forcing the hose out against the ferrule.

Fiber Length: Average length of commercial asbestos fiber as determined by the standard Quebec-shaking screen. Actually the diameters of the fiber clots, rather than the length of individual fibers, are measured, and method of preparation influences results greatly.

Fill: See *Weft.*

Filled Arch: An arch which has been completely filled with soft rubber so that it does not provide a pocket for the accumulation of fluid.

Filler: (1) A material incorporated into a rubber compound to increase its bulk. (2) A compound built into a rubber product to increase its bulk and/or improve its appearance. (3) Sometimes erroneously used to mean "filling" in textiles. (4) The transverse strength member in a circular woven reinforcement.

Filler Coat: A skim of rubber or rubber-like material calendered on to the frictioned filler fabric. (See *Skim or Skim Coat.*)

Filler Fabric: A fabric used as a filler.

Filler Friction: A rubber or rubber-like impregnation of the filler fabric.

Filler Gum: A rubber or rubberlike compound used as a filler.

Filler Ring: A ring of rubber or other material used to fill the hinge of a V-ring.

Filler Seam: Seam where filling material is placed in the void formed by the open seam.

Fin: See *Flash.*

Finger Spring: A spring of flat sheet metal, stamped with fingers.

Finish Fabric: See *Impression, Fabric.*

Finish, Paper: Finish resulting from curing in contact with paper.

Finish, Plate: (1) See *Mirror Finish.* (2) (More generally)—Same as *Plated Finish.*

Finish, Platen: Finish resulting from curing in contact with commercially smooth, but not polished press platen.

Fire Resistant: Retards the burning action of fire or flame.

Fish Scaling: A scaly coating of the surface by overlap of thin plates or leafs of rubber, usually resulting from uneven flow through die or mold.

Flame Polish: The glossy surface produced on plastics by fusion of the surface accomplished by passing through a flame.

Flame Resistant: See *Fire Resistant.*

Flange: (1) Metal ring attached to pipe nipples. (2) Raised edge on rubber articles.

Flanged End. Turned up or raised end so made that it can be bolted to an adjacent flange.

Flange Gasket: A gasket employed in a flange joint.

Flange Gasket Pre-Stress: Axial stress developed against, or by, a flange gasket at the time of initial tightening.

Flange Gasket Residual-Stress: Axial stress developed against, or by, a flange gasket at some interval after initial tightening. Is less than pre-stress by the amount of combined relief and creep-relaxation.

Flange Gasket Stress: Axial stress developed against, or by, a flange gasket.

Flange Joint: A joint formed by two abutting flanges.

Flange Packing: See *Hat Packing.*

Flange-Rectangular: A raised edge with rectangular cross-section.

Flange Square: A raised edge of square cross-section.

Flare: A feature whereby the lip diameter differs from the heel diameter.

Flare Angle: Angle between an element in the lip surface and a line parallel to the axis.

Flash: Material protruding from the surface of a molded part, appearing at the mold parting line or mold vent points.

Flat Cure: (1) A rubber compound with a curing rate at which physical properties change only slightly over a wide range of time for vulcanization. (2) A method of curing fire hose in a flat form.

Flat Diaphragm: A diaphragm packing in the form of a flat disk, designed generally for attachment to one member at the rim and to the other member at the center.

Flat Duck: A type of duck in which the warps are in pairs.

Flat Spots: Flat areas on surface of mandrel-cured hose caused by deformation during vulcanization.

Fleeting Angle: The angle of entry of a V-belt into the plane of the sheave groove.

Flex Cracking: A surface cracking induced by repeated bending or flexing.

Flex Life: The relative ability of a rubber article to withstand dynamic bending stresses.

Flex Test: A laboratory method used to evaluate the resistance of an article to repeated bending.

Flexibility: Opposite of stiffness.

Flexing Life Test: A laboratory method used to determine the life of a rubber article when exposed to dynamic bending stresses.

Floating Breaker: Leno or cord breaker embedded in a cover, usually in the center of the top cover.

Flow Cracks: Surface imperfections due to improper flow and failure of stock to knit or blend with itself during the molding operation.

Flow Lines: See *Flow Marks.*

Flow Marks: Similar to *Flow Cracks,* but the depressions are not quite so deep.

Flow Number: The number expressing the thickness of a pellet, after compression, in a flow plastometer, usually associated with the Williams plastometer.

Flowed-in Gasket: A gasket made *in situ* by drying a solution or dispersion.

Fluid Relief: Loss of gasket load resulting from the introduction of fluid pressure into the interior of a bolted flange joint, and consequent development of tension stresses in the walls of the container.

Flushing Connection: A connection to a lantern ring located at the inner end of the packing set and fed with a large volume of sealing fluid.

Fold: Where material is doubled over.

Fold-Back: See *Fold-Over.*

Folded-and-Doubled: Roll-folded from both edges to the center and doubled along the center.

Folded-Edge: (1) A belt construction wherein the inner carcass is enclosed in an envelope ply or plies. (2) An edge where an outer covering has been wrapped around a carcass and folded over the edge so that the carcass is closed on the edges.

Folded Endless: Folded from a fabric strip which has previously been made into an endless sleeve.

Folded-Fabric Packing: A packing made by creasing and folding a rubberized fabric strip, or series of such strips joined end to end.

Fold-Over: Where a material is doubled back upon itself, thereby forming a crease.

Folded (Packing): Constructed from folded strips of rubberized fabric.

Follower: (1) (Stuffing Box)—Same as *Gland Follower.* (2) (Cup)—Same as *Inside Follower.*

Foreign Material: Any extraneous matter such as wood, paper, metal, sand, dirt, or pigment that should not normally be present in a particular rubber product or composition.

FPM: Abbreviation for "Feet per Minute."

Free Length: (1) The lineal measurement before subjecting to a load or force. (2) The lineal measurement exclusive of fittings or couplings.

Freeze Resistant: See *Cold Resistant.*

Friction: (1) A rubber adhesive compound applied to and impregnating a fabric, usually by means of a calender with rolls running at different surface-speeds; hence the name "friction." The process is called "frictioning." (2) Resistance to motion due to the contact of surfaces. (3) Erroneously used to denote adhesion.

Friction Coat: An impregnation of rubber material calendered by friction motion to a fabric so that the material is forced into the weave of the fabric.

Friction, Coefficient of: The ratio between the force pressing the surfaces together and the force required to move it.

Friction, Kinetic: The force which is required to keep a body sliding at a uniform rate. Also called "friction of motion."

Friction (Packing): Force developed by a sliding packing on a moving rigid member, in the direction opposite to the motion. Or the force developed on the packing in the direction of motion. Expressed numerically in lbs. or lbs. per square inch of wear face, or in lbs. per circumferential inch.

Friction Pull: See *Adhesion.*

Friction, Static: The force which is required to start a body sliding.

Friction Surface: The exposed portion of a rubber product formed by a layer of rubber impregnated fabric, as distinguished from a product having the fabric completely covered with a layer of rubber.

Frictioned Fabric: Coated with rubber compound on a friction (uneven speed) calender.

Frosting: A very fine surface graying or whitening, usually due to a chemical reaction of the pigment at the surface, also due to breakdown of the elastomer exposing pigment. It is usually distinguished as different from *Bloom* since it is not readily removable by solvents. (See *Chalking* and *Crocking.*)

Full Thread: One complete helical convolution, having at all points a full thread cross-section.

Full-Face Gasket: A gasket covering the entire flange surface and drilled with bolt holes.

Fungicide: A material that prevents or retards the growth of fungi.

Fuzzy: A surface showing light particles or fiber linters partially embedded in the surface, usually noted when cured in contact with fabric which is later removed as in wrapped or drum curing.

G

Gage: (1) The measure of thickness of the individual elements making up a rubber product. (2) A device for measuring. (See *Thickness.*)

Garter Spring: A helical wire spring with ends connected. Used in tension to force the lip of a hat packing or radial seal inward. Occasionally used in compression.

Gasket: A packing employed in a joint whose members remain in essentially stationary relation.

Gasketing: Material in bulk form from which gaskets may be cut.

Gland: (Old meaning)—Same as *Stuffing Box.* (Newer meaning)—The movable end wall of a stuffing box.

Gland Follower: A member protruding into a stuffing box and designed to compress the packing.

Gooseneck: A hollow device bent to any specified radius; the bending is of such a nature as not to constrict the water-way.

Grab Method: In the physical testing of woven fabrics, the method of determining tensile strength by the use of a piece of fabric much wider than the jaws of the testing machine. The width of fabric tensioned is determined by the width of the jaws, which is usually one inch; the two jaws are set initially three inches apart. (ASTM Designation D-39.)

Grain: The effect on a rubber compound due to processing it through a tubing machine, calender, or mill.

Graphited: Having received an application of graphite.

Graphited-Throughout: Braided from yarns which have received a prior application of graphite, or, in the case of braid-over-braid construction, an application to each successive braid.

Gravity: See *Specific Gravity.*

Grommet: A flanged eyelet, used to reinforce a structural opening or protect the member passing through the eyelet.

Groove Gasket: A gasket for use in a groove.

Ground Finish: Surface produced by grinding or buffing. (See *Buffing.*)

Gum Seam: Seam made in a ply which has no reinforcement.

Gyration (Shaft): Rotation around an axis not coincident with its geometrical axis.

H

Half-Octagon Ring: A packing ring of half-octagonal cross-section, used like an O-ring.

Hank: A unit of length used in determining yarn number. The number of 840 yard hanks of cotton per pound avoirdupois.

Hardening: An increase in hardness, as shown by some penetration test.

Hardness: Property or extent of being hard. Measured by extent of failure of the indentor point of any one of a number of standard hardness testing instruments, to penetrate the product.

Hat Packing: A sliding packing operating against any inner reciprocating or rotating member, of hat shaped cross section—i.e., with an axially extended inner rim. Less frequently used as a gasket.

Hawser Twist: A cord or rope construction in which the first and second twists are in the same direction while the third twist is in the opposite direction, i.e., S-S-Z.

Heat Resistance: The property or ability of rubber articles to resist the deteriorating effects of elevated temperatures.

Heel: Base of working face of cup, hat, U-, or V-packing.

Heel Clearance: Half the difference between heel diameter and the diameter of the working surface against which it operates.

Heel Diameter: (Cup, hat packing, U-packing, V-packing)—Diameter of heel which may be outside (cup), inside (hat packing), or both (U- or V-packing). If the corner of the packing is curved, heel diameter is the diameter of the line of tangency of the curve to the working face.

Helical Cord Hose: A reinforcement formed of plurality of cords wound in helices around the body of a hose.

Helix: Shape formed by spiraling a wire or other reinforcement around the cylindrical body of a hose.

Herringbone Wrap: A narrow herringbone-woven tape spiraled circumferentially over the outside to apply external pressure during vulcanization. (See *Wrapped Cure.*)

Higbee: A thread, whose outermost convolution has been removed to such an extent that a full cross-section of the thread is exposed; this exposed end is beveled.

High Spot: A protrusion above the general surface of an object.

Hinge: Portion of V-ring cross-section reduced in area to facilitate flexing of the lips.

Holland Sheeting (Cloth): A sheeting cloth to which has been applied a glazed finish by applying an oil and filling material or starch followed by a thorough calendering.

Homogeneity: Uniformity of composition throughout the material.

Homogeneous: (1) (General)—Of uniform composition througout. (2) (Compressed asbestos sheet)—Not laminated.

Horseshoe: A surface fold-over of a definite U-shaped pattern, thus name horseshoe. Particularly used in describing a squeezed-out blister in conveyor belt covers. Also called *Ring Blisters* and *Dog Ears.*

Hose Clamp: A metal collar or strap used to hold hose on to a fitting.

Hose Duck: An open-weave duck made from plied yarns with approximately equal strength in warp and filler directions; used primarily in the manufacture of hose and packings.

Hydraulic Packing: A slab packing composed of superfine cot-

ton friction plies—used mainly for piston rings. (See *Fabric Slab.*)

Hydraulic Pressure: A force exerted through fluids.

Hysteresis: (1) (General)—Irreversible resistance to displacement. Measured by work lost in a complete cycle of deformation and retraction. (2) (Diaphragm)—Work lost in a complete cycle of deflection and recovery under a varying fluid pressure.

Hysteresis Loop: (1) (General)—Area between stress-strain curves of increasing and reducing stress. A measure of hysteresis. (2) (Diaphragm)—Area between pressure-deflection curves under rising and falling pressures. A measure of diaphragm hysteresis.

I

Immediate Set: The deformation found by measurement immediately after removal of the load causing the deformation.

Immersion: Placing an article into a fluid—generally so it is completely covered.

Impact: The single instantaneous stroke or contact of a moving body with another either moving or at rest, such as a large lump of material dropping on a conveyor belt.

Impregnation: To fill the interstices of an article with a rubber compound. Generally applies to treatment of textile fabrics, yarns, and cords.

Impression: (1) Design formed during vulcanization in the surface of any rubber article by a method of transfer, such as fabric impression, molded impression. (2) Printed copy obtained from molded rubber plates or engraved rubber sheet.

Impression, Fabric: Impression formed during cure by fabric jacket or wrapper.

Impression Top: See *Rough Top.*

Impulse: Application of force in manner to produce sudden strain or motion such as hydraulic pressure applied in a hose or diaphragm.

Indentation: (1) The extent of penetration by the indentor point of any one of a number of standard hardness testing instruments. (2) A recess in any surface of a rubber article.

Inhibit: To prevent or retard.

Inside Depth: (1) (Packing ring or set)—Depth of inside periphery. (2) (Cup, hat packing, U-packing)—Axial dimension from inside surface of base to plane of lip.

Inside Follower (Cup): A washer employed to compress the base against the adjacent piston face.

Inside Packed: With packing inaccessible from outside, as in a piston packing.

Inside Working Diameter (Diaphragm): Outside diameter of area supported by the piston. Where the piston edge is filleted, it is customary to consider the filleted area as "supported."

Instantaneous Modulus: Slope of stress-strain curve at a single point, employed when modulus varies from point to point.

Interlocking Braid: A solid braid constructed in a special braider with special yarns criss-crossing the section. Generally square.

Internal Expanded Coupling: A coupling whose shank is expanded after insertion into the hose, forcing the hose out against the restraint of a ferrule or bowl.

Intrinsic Viscosity: The ratio of the difference between the viscosity of the solution at the given concentration and the viscosity of the pure solvent to the product of the viscosity of the pure solvent and the volume concentration of the solution. Volume concentration is expressed as:

$$\frac{\text{cc. (solute)}}{\text{100 cc. (solution)}}$$

Intrinsic viscosity is computed on the benzene soluble portion of the elastomer and is numerically equal to:

$$\frac{2.303 \times \log_{10} \times \text{relative viscosity}}{\text{grams of elastomer per 100 ml. of benzene}}$$

Iron: (1) Process used to dry fabric before impregnating with rubber compound or other processing. (2) Strip of metal used during vulcanization to confine the edge of flat rubber products in a press. (3) A classification of thickness used in shoe products; 1 iron equals $\frac{1}{48}$ of an inch.

Irregular: Not uniform.

Izod Impact: A test using a vertical notched rubber specimen supported as a cantilever. The sample is broken by a pendulum blow delivered at a fixed distance from the edge of a clamped specimen. The test requires the notch in the sample to produce a standard degree of stress concentration.

J

Jacket: (1) A seamless tubular braided or woven ply generally exposed on outside. (2) A woven fabric used during vulcanization by the wrapped cure method.

Jacket, Woven: See *Woven Jacket.*

Joint: An interstice between rigid members of a fluid container.

Joint (Male-and-Female): A tongue and groove joint in which the groove has no inner wall, i.e., is merely a counter-bore.

Jointing (British): See *Gasketing.*

Junket Ring: See *Anti-Extrusion Ring.*

Junk Ring: See *Anti-Extrusion Ring.*

K

Kinking: A temporary or permanent distortion of a product, induced by winding or doubling upon itself.

Knitted Ply: Spirally interlaced loops of yarn forming a continuous tubular structure.

Knitter: A machine capable of forming a fabric by the action of needles engaging threads in such a manner as to cause a sequence of interlaced loops. Spirally interlaced loops forming a continuous tubular structure are commonly used as hose reinforcement.

Knot: A joining by tying together.

Knurl: A series of small knobs or ridges, usually on the exterior surface of a swivel.

L

Laminated: Built up from thinner layers.

Laminated Cover: Cover formed to desired thickness from thinner layers vulcanized together.

Lamination: A single thickness of material used in laminating a product to the required thickness before vulcanization. (See also *Laminated.*)

Lantern Ring: A rigid ring generally of H-shaped cross-section located in the interior, or at one end, of a packing set and communicating with a port or ports in the stuffing box wall, or moving member.

Lap: A part that extends over itself or like part, usually by a desired and predetermined amount.

Lap Seam: A seam made by placing the edge of one piece of material extending flat over the edge of the second piece of material.

Lateral Misalignment (Pipe): Vertical distance between axes of pipes to be joined.

Lathe Cut: Cut from sleeve on a lathe.

Lay: The amount of advance of any point in a strand for one complete turn.

Lay, Angle of: See *Angle of Lay.*

Lay, Cable: See *Cable Lay.*

Lay, Spiral: See *Spiral Lay.*

Layer: A single thickness of rubber between adjacent parts.

Lead Burst: A leak in lead-press hose during vulcanization caused by a burst of the lead covering.

Lead Chip Marks: Minor nicks or marks in the surface of the cover of lead-press hose caused by particles of lead (flakes) sloughing off the lead-press die during the process of lead covering.

Lead Dent: Any indentation in the surface of lead-press hose caused by denting the lead covering before vulcanization.

Lead Die Marks: Longitudinal lines or marks in the cover of lead-press hose caused by scratches, etc., in the lead press die forming the lead pipe.

Lead Discoloration: A dark discoloration in the cover of

colored lead-press hose caused by a chemical reaction of the lead with the rubber compound.

Lead Flakes: Tiny flakes of lead which remain on the cover of lead-press hose after the lead covering has been stripped from the hose.

Lead-Press Corrugated: A ribbed or corrugated exterior surface obtained by the lead-press method.

Lead-Press Cure: A process wherein an extruded lead sheath acts as a restraining member or mold during vulcanization.

Lead-Press Finish: The type of exterior surface obtained by the lead-press method.

Lead-Press Joint: See *Charge Mark.*

Lead Press Smooth: A smooth exterior surface obtained by the lead press method.

Lead Stop: See *Charge Mark.*

Leaker: (1) A crack or hole in the tube which allows fluids to escape. (2) A hose assembly which allows fluids to escape at the fittings or couplings.

Legs: Tension filaments appearing when raw cemented or frictioned plies are pulled apart. (Also see *Teeth.*)

Length: A lineal dimension, usually the longer or longest dimension of the product.

Length, Random: See *Random Length.*

Length Tolerance: A specified allowance from a standard or given length.

Leno Breaker: An open-mesh fabric made from coarse ply yarns, with a leno weave. A leno weave is one in which certain warp threads—termed doup or crossing threads—are passed from side to side of one or more ends—termed standard threads—and are bound in by the filling in this position. Where the crossed interlacing occurs, an open, perforated structure is formed.

Life Test: A laboratory procedure used to determine the amount and duration of resistance of a rubber article to a specific set of destructive forces or conditions. (See *Accelerated Life Test.*)

Lift Valve: See *Poppet Valve.*

Light Cover: A cover relatively thin in gage. (Also see *Thin Cover.*)

Light Resistant: Withstands the deleterious action of light, such as cracking.

Light Tube: A tube relatively thin in gage. (Also see *Thin Tube.*)

Linear Expansion: Expansion in any one linear dimension, or the average of all linear dimensions.

Lined Bolt Holes: Bolt holes which have been given a protective coating by the addition of a lining material to cover the internal structure.

Lined Hose: Fire hose having a seamless woven jacket or jackets and an internal rubber tube.

Lining: (1) A protective rubber sheet. (2) A hose tube.

Lip: (Cup, hat packing, U-packing, V-packing)—An axially extended rim.

Lip Diameter: (Cup, hat packing, U-packing, V-packing)—Diameter of tip of lip, which may be outside (cup), inside (hat packing), or both (U- or V-packing).

Lip Gasket: (1) Any gasket which is self-tightening by virtue of a protruding lip. This includes cups, hat packings, U-packings, etc., when used as gaskets. (2) A gasket with lip used for attachment.

Lip Interference: Half the difference between lip diameter and the diameter of the working surface against which it operates.

Lip Packing: (1) (General)—A cup, hat packing, or U-packing. (2) (Restricted) A hat packing with a thickened rim.

Lip Seal: See *Radial Seal.*

Lip Thickness: (Cup, hat packing, or U-packing)—Radial dimension—measured at right angle to lip surface.

Long Handles: A pair of projecting fingers on a coupling long enough for hand-tightening the coupling.

Longitudinal Cord Breaker: A cord breaker laid in parallel to the edges of the belt.

Longitudinal Seam: A seam joining two materials in the length of the finished product.

Loop Edge: A selvage formed by having the filling loop around a catch cord or wire, which is later withdrawn, leaving small loops along the edge of the cloth.

Loop-Edge Tape: A tape woven with a selvage edge formed by looping the fill threads to prevent raveling, allowing extensibility for even tensions.

Loose Cover: Separation of the cover from adjacent fabric or reinforcements.

Loose Edge: The separation of the edge of a fabricated product reinforced with textile or other reinforcements.

Loose Ply: Separation between adjacent plies.

Loose Tube: Separation between tube and adjacent structural component.

Low Spot: A depression below the general surface of an object.

Low-Temperature Flexibility: The ability of a rubber product to be flexed, bent, or bowed at low temperatures.

Low-Temperature Flexing: Act or instance of repeated bending or bowing a rubber product under conditions of low temperature. (See *Cold Flex.*)

Lubricant Seal: A sealing connection introducing oil or grease as a sealing fluid.

Lubricated: Impregnated or surface-treated with some material which is assumed to have a lubricating function on a sliding surface. Often a misnomer since such materials do not function as true lubricants.

Lug: (1) A projection on the outside surface of a coupling, serving to engage a spanner wrench. (2) A projection on the inner surface of a rim to prevent creeping or movement on the rim.

Lug Spring: See *Finger Spring.*

M

"M" Value: An empirical design constant of a flange gasket used in ASME Code for Unfired Pressure Vessels. The Code equation defines this term as the ratio of residual gasket load to fluid pressure at leak. The definition of "m" has varied in successive editions of the Code, according to the method employed for computing residual gasket load.

Machine Made: (1) Mandrel-built reinforced hose made by machine, as opposed to hose built by hand. (2) Tubing that is processed without internal support.

Mandrel: A form usually of elongated section used to size and support a product during fabrication and/or vulcanization. It may be rigid or flexible.

Mandrel Built: A product fabricated and/or vulcanized on a mandrel.

Mandrel Wrapped: Built up by wrapping thin unvulcanized sheet on a mandrel.

Marcel Spring: See *Wave Spring.*

Matching: The act of comparing two or more articles for sameness in appearance, dimensions, or color.

Matching V-Belts: Two or more V-belts that have rotational lengths within specified limits.

Maximum Diameter: The greatest admissible diameter in a given case.

Mean Diameter: As in a hose, tubing, or cylindrical article, the average diameter of the extreme dimensions of the article as a whole or any specific component thereof.

Mechanical Seal: See *Axial Seal.*

Metal-Foil Packing: Wide metal foil, treated with a binder, and twisted or wrapped on itself to make a coil, which can be converted to spiral or ring. This type not often rubberized.

Migration: The transfer of an ingredient in a rubber compound from one layer to an adjacent layer or to the surface.

Migration Stain: When staining occurs on the area of an object adjacent to the rubber article, it is known as "migration stain."

Mildew: Growth on organic matter produced by fungi, generally in textile components of rubber articles. Usually causes deterioration of the textile.

Mildew Inhibited: The article contains material to prevent or retard mildew.

Mildew Inhibitor: See *Fungicide.*

Mildew Resistant: Withstands the action of mildew growths and their deteriorating effect.

Mildewcide: See *Fungicide.*

Mirror Finish: A bright, polished surface.

Misalignment: Departure from alignment.

Modulus: (1) A coefficient or numerical measure of some property. (2) In rubber, modulus usually refers to one of several measurements of stiffness or resistance to deformation. The use of the word without modifying terms may be confusing, and such use should not be encouraged. Modulus in rubber may be either static or dynamic; static moduli are subdivided into tangent, chord, and compounder's. Compounder's modulus is always in tension, but all the others may be in shear, compression, or tension. Other terms used in connection with "modulus" are elasticity; rigidity; Young's; tangent; elongation (which see). (3) All elastic moduli in rubber (except compounder's) are ratios of stress to the strain produced by that stress; the strain is expressed fractionally; the units of the modulus are the same as those for the stress, usually psi.

Modulus at 300% (or Other % Elongation): See *Compounder's Modulus.*

Modulus of Elasticity: One of several measurements of stiffness or resistance to deformation, but often incorrectly used to indicate specifically static tension modulus. See *Modulus.*

Modulus of Rigidity: See *Shear Modulus.*

Moisture Absorption: The absorption of moisture by a rubber or textile product.

Moisture Regain: The reabsorption of moisture in a rubber or textile product.

Mold Cavity: Hollow space or cavity in the mold which is used to impart the desired form to the product being molded.

Mold Finish: The uninterrupted surface produced by intimate contact of the rubber with the surface of the mold cavity during vulcanization. Also see *Mold Skin.*

Mold Lubricant: The material used to coat the surfaces of a mold to prevent the rubber adhering to the metal during vulcanization.

Mold Marks: Indentations or ridges embossed into the skin of the molded product by irregularities in the mold cavity surface.

Mold Register: Means used to align the parts of a mold.

Mold Release: See *Mold Lubricant.*

Mold Scratches: See *Mold Marks.*

Mold Skin: The surface of a molded product formed by contact with the mold.

Mold Wash: (1) A preparation used to prevent sticking to molds. (2) The residue left on the molded article.

Molded: (1) Cured in a mold. (2) (Not preferred)—See *Die-Formed.*

Molded Diaphragm: A diaphragm packing, generally in some contour other than flat, prepared by molding.

Monomer: A simple chemical compound which enters into the production of a polymer.

Mooney Scorch: The measurement of the rate at which a rubber compound will precure or set up by means of the Mooney viscometer.

Mooney Viscosity: The measurement of the plasticity or viscosity of uncompounded or compounded unvulcanized rubber and rubber-like materials by means of the Mooney shearing disk viscometer. Ref. ASTM D-927.

Mortise Join (Packing Ring): See *Step Joint.*

Multiple-Carrier Braid: A solid or hollow braid constructed on a Maypole braider with more than 8 carriers, giving normally a polygonal cross-section.

N

Necking Down: The diminution of the cross-sectional area of a rubber product.

Nerve: Usually applied to unvulcanized rubbers or compounds. Refers to degree of toughness or resistance to deformation.

Net Endless Length: The manufactured length necessary to provide adequate service under operating conditions.

Nick: A small notch, slit, or cut.

Nip: The clearance between rolls of a mixing mill or calender. (See *Bite.*)

Nipple: A cylindrical pipe-like attachment, usually metallic, one end of which is securely inserted and retained in the end of the hose. The inserted end may be plain, or banded, that is, with attached external circumferential bands, or grooved (scored), that is, having circumferential grooves depressed in the external surface.

Nominal Length: The desired length from which tolerances are set. (See *Length Tolerance.*)

Non-Blooming: The absence of bloom.

Non-Fill: Improperly filled, not completed, containing voids.

Notch: (1) A V-shaped indentation or hollow. (2) A nick in the surface of a rubber product. (3) Notched V-belt, a V-belt cut or produced with a series of evenly spaced V-shaped indentations in the inner face. (See *Cog.*)

Nozzle End: An end of hose in which both the inside and the outside diameters are reduced.

Number (Cotton Yarn): The number of hanks in a pound.

Numbered Duck: A duck similar to Army duck, but made in a limited number of weights, which are designated by numbers.

Nut: A perforated block, usually metallic, with an internal thread.

O

Octagon Ring: A packing ring of octagonal cross-section, used like an O-ring.

Off Center: In any fabricated rubber article where eccentric wall or eccentricity exists. Also cases where inner and outer elements are not of uniform gage with respect to a center element.

Off-Center Ply: Ply of fabric not evenly spaced between equal gage covers and/or layers in C. I. or diaphragm packing.

Off Gage: Not conforming to thickness specified.

Oil Resistant: Withstands the deteriorating effect of oil (generally refers to petroleum) on the physical properties.

Oil Seal: A radial seal designed primarily for the retention of oil in bearings, etc.

Oil Swell: The change in volume of a rubber article due to absorption of oil.

Oilproof: Not adversely affected by exposure to oil.

Optimum Cure: State of vulcanization at which maximum desired property is attained.

Open Seam: Seam where edges do not meet, forming a void.

O-Ring: A packing ring of round cross-section used alone, or with end rings, in a groove. If used in a groove of proper dimensions, it is self-tightening.

O-Ring Gasket: A groove gasket of round cross-section.

O-Ring Static Seal: See *O-Ring Gasket.*

Outside Depth: Depth of outside periphery.

Outside Packed: With packing accessible from outside, as in a rod, plunger or ram packing.

Outside Working Diameter: (Diaphragm)—Inside diameter of area supported by rim. Where the inner edge of the rim is filleted, it is customary to consider the filleted edge as "supported."

Oven: A low-pressure hot-air chamber used for the purpose of heating, drying, baking or vulcanizing rubber products. (See *Aging, Air Oven.*)

Overcure: A degree of cure greater than the optimum.

Overweight: Over in specified weight tolerances.

Oxidation: The reaction of oxygen on a rubber product, usually detected by a change in the appearance or feel of the surface or by a change in physical properties.

Oxygen Bomb: A chamber capable of holding oxygen at an elevated pressure, which can be heated to an elevated temperature. Used for an accelerated aging test.

Ozone Resistant: Withstands the deteriorating effects of ozone (generally cracking).

P

Pack: To control leakage by means of packing.

Packing: (1) A deformable element employed in a joint to eliminate or minimize leakage. (2) Material in bulk form from which packing may be cut.

Packing Coil: Packing in coil form from which packing rings may be cut.

Packing Groove: A groove carved in a flange, or in one member of a concentric joint, to accommodate a packing.

Packing Hook: A tool similar to a corkscrew for removing packings from a stuffing box.

Packing Ring: A sliding packing generally employed in a stuffing box, alone or as a component of a set.

Packing Set: A plurality of packing rings designed to fill a stuffing box.

Packing Space: (Packing ring or set)—Radial dimension.

Packing Spiral: Packing in helical form from which packing rings may be cut.

Packless: Employing no packing—frequently a misnomer as referring to fluid handling equipment packed with a seal or diaphragm.

Paper: A fiber mat produced by wet screening. May be subsequently treated with rubber solution, or other binder.

Paper Gasketing: Paper, usually treated, intended for gasketing use.

Pedestal Ring: An adapter designed to support a U-packing in the center.

Peeling: The loosening of a rubber coating or layer from a base material, such as cloth or metal, or from another layer of rubber.

Performance Test: Same as *Service* or *Bench Test,* not conducted to failure.

Permanent Set: (1) Permanent set is the deformation remaining after a specimen has been stressed in tension a prescribed amount for a definite period and released for a definite period. (2) In creep determinations, permanent set is the residual unrecoverable deformation after the load causing the creep has been removed for a substantial and definite period of time.

Permeability: The quality or condition of allowing passage of liquids or gases through a rubber layer.

Pick: A single filling strand.

Pickless Cord Fabric: Cord fabric rubberized directly from cord without weaving, i.e., without weft or filling threads.

Pin Hole: A small puncture in any surface of a fabricated product.

Piston: The inner member of a concentric joint, the members of which reciprocate relative to each other, which contains the packing.

Piston Packing: Packing used on a piston in sliding contact with a cylinder wall.

Piston Ring: A piston packing used alone or in a set.

Pit: A surface depression.

Pitch: The distance from one point on a helix to the corresponding point on the next turn of the helix, measured parallel to the axis. Examples: The pitch of yarn, cord, or wire in a braided reinforcement; the pitch of an external wire winding or internal reinforcing wire helix in hose. Pitch is not to be confused with *Spacing,* which see.

Pitch Circumference: (1) Circumference of a pulley at the pitch line. (See *Pitch Line.*) (2) Same at pitch length. ("Pitch length" is the preferred term when referring to the length of a belt.)

Pitch Diameter: The diameter of a pulley taken at the pitch line. (See *Pitch Line.*)

Pitch Length: (1) The length of a belt along the pitch line. Whether or not the measurement is made under tension should be specified. (2) In V-belts, pitch length is the length along the arbitrary pitch line and under prescribed tension.

Pitch Line: (1) The line in the cross-section of a belt where the linear speed in traveling around the pulley is exactly the same as the linear speed in the straight portions of the belt. (2) In V-belt drives, arbitrary pitch line locations have been established which may deviate considerably from the true pitch lines as defined in (1).

Pitch (Thread): The distance from a point on the thread to a corresponding point on the next thread, measured parallel to the axis.

Pitted Tube: A condition of surface depressions on the inner lining usually caused by trapped air or lubricant.

Plastic Packing: (1) A coil, spiral, or ring packing prepared by extruding a compound consisting of a high percentage of fiber (generally asbestos) together with a binder, and with graphite, mica, metal particles, etc. optional, often encased in a skeleton cotton braid. (2) (Less frequently)—A packing made from a non-rubber plastic, such as nylon or Teflon.

Plasticity: The degree or rate at which unvulcanized rubber and rubber compounds will flow when subjected to forces of compression, shear, or extrusion through a die.

Plasticizer: A material which, when incorporated in rubber or a polymer, will change its hardness, flexibility, processability, and plasticity.

Plastometer: (1) An instrument for measuring the plasticity of raw or unvulcanized compounded rubber. (2) An instrument for measuring the penetration of an indentor point into the surface of a vulcanized rubber.

Plate Finish (Sheet): A smooth surface, usual result of vulcanization between press plates.

Plated Finish: The surface obtained by the deposition of a thin metallic film on the surface of a fitting, electrolytically or by dipping.

Plied Yarn: A yarn made by twisting together two or more single yarns.

Plunger: Same as rod, but larger. Normally used as a displacement member in a reciprocating plunger pump.

Plunger Packing: Sliding packing employed in contact with a plunger.

Ply: (1) A layer of rubberized fabric. (2) A layer formed by a single pass through a single deck of a yarn cord, or wire braiding machine. (3) A layer formed by a single pass through a single head of a yarn, cord, or wire knitting machine. (4) A seamless woven jacket consisting of warp and filler yarns and/or wire. (5) A layer consisting of multiple strands of cord or wire close spaced. (6) A layer formed by winding a single strand of cord or wire close spaced. (7) A single yarn in a composite yarn. (8) Used in processing as a layer of unvulcanized rubber compound.

Ply Adhesion: The force required to separate two adjoining strength reinforcing members in a rubber product.

Ply, Buckled: A deformation in a ply distorting it from its normal plane.

Ply Separation: Lack of adhesion between plies.

Ply, Torn: A cut or tear in a ply.

Ply, Wrinkled: See *Ply, Buckled.*

Ply Yarn: A yarn made by twisting together two or more single yarns in one operation.

Pock Marks: Uneven blister-like elevations, depressions, or pimpled appearance. (See also *Air Checks* and *Blisters.*)

Pocked Cover: Surface of cover marked with small solid circumscribed elevations or depressions.

Poisson's Ratio: The ratio of transverse deformation to the deformation in line with the applied force.

Polished Finish: The smooth mirror-like finish of a metallic fitting; secured by buffing with suitable polishing preparations.

Polymer: A material formed by the joining together of many (poly) individual units (mer) of a monomer.

Poppet Valve: A valve operating by raising and lowering a disk in relation to a seal.

Pores: Minute surface openings or globular structural voids.

Porosity: Quality or state of being porous due to presence of globular structural voids.

Porous Tube: (1) The physical conditions of a hose tube due to presence of pores. (2) A hose tube that has low resistance to permeation.

Power Factor: (1) The cosine of the angle of phase displacement between current and applied voltage. (2) A measure of the energy loss in a material, whether this loss is due to leakage or dielectric loss.

Pre-Cure: See *Semi-Cure.*

Pre-Load: Axial load developed against, or by, a flange gasket at the time of initial tightening.

Preservative: A substance added to or coated over a product to preserve the product against damage or deterioration.

Press Cold Ends: Ends of press cooled by water so that a semi-cured area at the end of the press length of the product will result, enabling that portion to be lapped on the next heat and revulcanized, making a complete cure on the lapped portion.

Press Laps: The portion of the previous press length of a product which has been revulcanized in curing the following lengths.

Press Length: The length of a product which can be vulcanized at one time in a press, limited to the length measurement of the press.

Press Marks: Irregularities in the surface of a vulcanized product caused by the press ends or by corresponding irregularities in the press surface.

Press Mold: The matrix or cavity in which a rubber product is shaped. Also includes the body containing the cavity which can be removed from the press.

Press Overlap: See *Press Laps.*

Pressure: A force or thrust applied over the surface as hydraulic pressure to a rubber product. Usually referring to pressure in a hose or against a diaphragm.

Pressure Face (Packing): End exposed to higher pressure.

Pressure Finish Cure: Vulcanizing process depending solely upon the pressure of the curing medium to exert the necessary external pressure. Commonly used for extrusions or all rubber tubing.

Pressure Gradient: Manner in which fluid pressure diminishes across wear face.

Pricker Marks: The marks due to perforating the cover of the hose prior to or after vulcanization.

Print Brand: A brand transferred to or printed on the product after manufacture.

Proof Pressure Test: A non-destructive hydraulic pressure test applied to a product to show up possible defects.

Proof Resilience: The energy required to stretch a piece of rubber from zero elongation to the breaking point. It is expressed in foot pounds of work per cubic inch of the unstretched rubber. Mathematically it is the integral measured in a stress-strain diagram by the area subtended on the strain axis by the stress-strain curve. It approximates tensile-product divided by two.

Proportional Limit: The greatest stress which a material is capable of developing without a deviation from the law of proportionality of stress to strain (Hooke's Law). Thus some portion of the stress-strain curve from the origin up is a straight line. The term ordinarily is not applicable to rubber, as very little, if any, of the stress-strain curve is a straight line. It is common practice to assume the stress-strain line to be straight for very small deformations.

Pulled-Down Tube: See *Loose Tube.*

Pulley Cover: See *Bottom Cover.*

R

Radial Seal: A shaft seal in which the packing member (generally a hat packing) contracts radially on the shaft.

Radial Stress: Stress directed against or by a packing in the radial direction.

Rag Wrap: Multiple layers of thin woven fabric torn to a given width to give plurality of continuous layers applied circumferentially in lengths equal to length of product to apply external pressure during vulcanization.

Raised Center: Conveyor belt cover where the center, in the area of greatest wear, is raised above the edges.

Ram: Same as plunger, but normally used as a displacement member in a reciprocating fluid motor.

Ram Packing: Sliding packing employed in contact with a valve stem.

Ramp (Expansion Joint): A conical outer layer, reaching its maximum diameter directly over an arch.

Random Length: A unit of material which does not fall into any current classification for standard length.

Raw Edge: The uncovered square edge of a belt created by cutting after vulcanization.

Recovery: The degree to which a rubber product returns to its normal dimensions or shape after being distorted.

Recovery (Sheet Gasketing): The % decrease in compressed deformation during a specified time interval and at a specified temperature, following release of load—as defined by ASTM D-1147.

Reinforced Cover: The cover of a fabricated elastomer reinforced with textile or other material. Usually applied to hose and belting.

Reinforcement: (1) The strength members, consisting of fabric, cord, and/or metal, of a rubber product. (2) The non-rubber elements making up a rubber product. (See *Carcass.*) (3) The non-rubber compounding ingredients which impart increased tensile strength or other desirable properties.

Relative Humidity: The ratio of the quantity of water vapor actually present in the atmosphere to the greatest amount possible at the given temperature.

Residual Load: Axial load developed against, or by, a flange gasket at some interval after initial tightening. Is less than preload by the amount of combined fluid relief and creep-relaxation.

Resilience: (1) In metals and some other materials, resilience is the amount of energy stored up in a deformed body, and as no loss of energy is contemplated, it is also the amount of energy recoverable when the force producing the deformation is removed. (2) In rubber or rubber-like materials subjected and relieved of stress, resilience is the ratio of energy given up on recovery from deformation to the energy required to produce the deformation. Resilience for rubber is usually expressed in %. (See also *Dynamic Resilience.*)

Resistance: The property or ability of matter to withstand the effects of force-pressure—heat or chemical action.

Resistant: Having resistance.

Retraction: (1) (General)—Decrease in strain following partial or complete elimination of stress. (2) (Flange gasket)—Partial or complete recovery of initial thickness following lessening of gasket stress.

Retraction Modulus: Slope of retraction curve—i.e., stress release divided by decrease in strain generally expressed as a fraction of initial thickness.

Reversed Step Ply: A conveyor belt having recessed upper ply or plies toward the edge to provide additional cover gage under guides and skirt boards. (See *Drop Ply.*)

Reversion: (1) The change which occurs in vulcanized rubber as the result of aging or overcuring in the presence of air or oxygen, usually resulting in a semi-plastic mass. (2) It is the basis of rubber reclaiming processes and is aided by the use of swelling solvents, chemical plasticizers, and mechanical disintegration to obtain a workable mass.

Rheological Phenomena: Pertaining to flow: those properties of plasticity, elasticity, and viscosity in liquids, solids, and plastics.

Ride-In: Describes the condition in which the top surface of a V-belt fits below the outer rim of the sheave.

Ride-Out: Describes the condition in which the top surface of a V-belt extends above the outer rim of the sheave.

Rind: (1) Radial dimension of a gasket. (2) See *Flash.*

Ring Blister: See *Horseshoe.*

Ring Gasket: A flange gasket lying wholly within the ring of bolts.

Rings: (1) Annular cylinders, made from ductile metal, usually brass, copper, or aluminum. (2) A round cross-section gasket of "O" design. (3) See *Horseshoe.*

Rod: The inner member of a concentric joint, the members of which reciprocate relative to each other, and in which the packing is contained in the outer member. Generally applied to an inner member of small diameter.

Rod Packing: Sliding packing employed in contact with a rod.

Roll Back: See *Horseshoe.*

Roll Belting: Belts made to ordered width, but of specified lengths for cutting later into shorter lengths.

Rolled-Endless: Rolled from fabric strip which has previously been made into an endless sleeve.

Rolled-Fabric Packing: A packing made by rolling a rubberized fabric strip or series of such strips joined end to end, generally bias cut, around itself, or around a core of some other material.

Rolled (Packing): Constructed from a strip of rolled rubberized fabric.

Rolled Thread: A thread formed on tubing by compression with a properly shaped roll, and without the removal of metal.

Roll-Folded: Folded in consecutive folds, starting from one edge.

Rope (Asbestos): Same as *Wick*, but generally larger and more tightly twisted.

Rotary Piston: A piston arranged to rotate rather than reciprocate.

Rotary Seal: (1) Any shaft seal. (2) An axial seal.

Rough Bore Hose: A wire reinforced hose in which the wire is exposed in the bore.

Rough Cover: Cover having irregularities, ridges, projections, or the like producing a broken surface, not smooth. (See also *Rough Top.*)

Rough Edge: An edge of belting or packing that is less smooth or regular than commercial practice. Belts cured without side irons are sometimes referred to as rough-edge belts.

Rough Top: Cover intentionally made to have irregularities, ridges, or projections to produce a broken surface for greater traction or carrying abilities.

Rough Trim: Removal of superfluous parts by pulling or picking. Usually a small portion of the flash or sprue remains attached to the product.

Round-Body Gasket: See *O-Ring Gasket.*

Round-Body Packing Ring. See *O-Ring.*

Roving (Asbestos): An untwisted strand of asbestos fiber as it leaves the carding machine.

RPM: Abbreviation for "Revolutions per Minute."

Rubber-Bonded Plastic Packing: A plastic packing in which the binder is a solution of some sort of rubber in a volatile solvent; the solvent is later expelled.

Rubberized: Coated with a rubber compound.

Runout (Shaft): Same as *Gyration.* When expressed in inches alone, or accompanied by abbreviation "TIR" (total indicator reading) refers to twice the radial distance between shaft axis and axis of rotation.

Russell Effect: The power, after exposure to light, to produce an image on a photographic plate. The effect is due, not to radiation, but to the chemical action of hydrogen peroxide which was formed by the reaction caused by the light rays.

S

Sand-Cast Finish: The exterior surface finish of a cast fitting, this surface being that of the casting as it is removed from the mold, but with the casting flash removed.

Scarf Joint: See *Bevel Joint.*

Scoring. A variety of wear in which the working face acquires grooves, axial or circumferential, according to whether the motion is reciprocating or rotary. Also applied to a similar effect on the rigid member.

Scraper Ring: See *Wiper Ring.*

Scratch: Surface blemish, a sharp or ragged mark, on finished item by a scored or scratched mold, matrix, or press platens or the finished product being cut after cure.

Scuffing: A variety of wear in which the working face is roughened.

Seal: (1) Same as packing. (2) A packing which is self-tightening, i.e., requires no manual adjustment. (3) A sealing connection, as a water-seal.

Sealing Connection: A connection admitting a sealing fluid to a lantern ring within a set, or to the space between two packings, such as twin axial seals.

Sealing Fluid: A fluid introduced into the interior of a packing set via a lantern ring, or into the space between two packings, at a pressure higher than that of the fluid being packed, so that the sealing fluid leaks through the packing in lieu of the fluid being packed.

Seam: A line formed by joining material to form a single ply or layer.

Seam, Bias: See *Bias Seam.*

Seam, Butt: See *Butt Seam.*

Seam, Cover: See *Cover Seam.*

Seam, Lap: See *Lap Seam.*

Seam, Longitudinal: See *Longitudinal Seam.*

Seam, Transverse: See *Transverse Seam.*

Seaming Strip: Strip of material laid over the seam to act as a binder.

Seamless Folded: Folded from a length of rubberized tubular-woven fabric.

Selvage Edge: The lengthwise woven edge of a fabric.

Semi-Cure: Partially cured. (A term frequently used to designate the first cure of an article that is given more than one cure in its manufacture.)

Sensitivity: (Diaphragm)—Absence of resistance to displacement by light fluid pressures.

Separator: A thin ring of stiff material such as sheet metal, Teflon, etc., interposed between adjacent packing rings to permit rings to slide over one another and thereby function independently.

Separator Diaphragm: A diaphragm between two fluids at substantially the same pressure and, hence, under little or no stress.

Service Test: A test in which the packing is made to operate under service conditions, in the actual equipment.

Set: Retention of strain following release of stress. The opposite of retraction.

Shaft: The inner member of a concentric joint, the members of which rotate relative to each other, and in which the packing is contained in the outer member.

Shaft Packing: Sliding packing employed in contact with a shaft.

Shaft Seal: A shaft packing designed to be self-tightening.

Shank: That portion of a coupling which is inserted into the hose end.

Shape Factor: The ratio of the area of one load face to the combined area of those surfaces free to expand laterally when the rubber is under compression.

Shear Modulus: The ratio of the shear stress to the resulting shear strain (the latter expressed as a fraction of the original thickness of the rubber measured at right angles to the force). Shear modulus may be either static or dynamic.

Sheet Gasketing: Gasketing in sheet form.

Sheeter: The special calender employed in the manufacture of compressed asbestos sheet.

Shell (Radial Seal): A metal cup in which the packing member is assembled, or to which it is vulcanized.

Shiplap Joint: See *Tangential Step-Joint.*

Shock Load: A stress created by a sudden force.

Shoulder Seal: See *Axial Seal.*

Shredded Metal Packing: Narrow strips of metal foil (or flattened wire) dipped in a binder and twisted into a coil, which can be converted to spiral or ring. Binder is usually rubber applied as a solution.

Shrinkage: A decrease or contraction in dimension.

Simulated Service Test: See *Bench Test.*

Single-Acting Piston: A piston with fluid on one side only.

Single-Filling Duck: A type of flat duck with a single-yarn filling.

Sink Blisters: See *Sinks.*

Sinks: A collapsed blister or bubble leaving a depression in the product.

Skeleton Braid: A multiple-carrier braid of open pattern.

Skim or Skim Coat: A layer of rubber material laid on a fabric, but not forced into the weave—normally laid on a frictioned fabric.

Skimmed Fabric: Coated with rubber on a calender. The skim coat may or may not be applied over a friction coat.

Skive: A cut made on an angle to the surface to produce a tapered or feathered cut.

Skive Edge: An edge that has been cut with a skive.

Skive Joint: See *Bevel Joint.*

Slab: Thick sheet, generally laminated.

Slab Packings: Coil, spiral, or ring packings cut from fabric slab.

Sleeve: A short tube, generally of large diameter.

Slick Tube: Area of low adhesion between tube and adjacent fabric ply or layer evidenced by a glossy surface.

Sliding-Contact Packing: See *Sliding Packing.*

Sliding Packing: A packing employed in a joint whose members are in relative motion.

Sliding Seal: (1) See *Sliding Packing.* (2) A self-tightening sliding packing.

Sliver (Asbestos): A fluffy assemblage of asbestos fibers, generally ½-inch diameter or larger taken from a carding machine with no twist, or a very slight twist.

Slotted: A type of coupling having equally spaced axial slots on the external surface of the coupling; these slots replace lugs or handles and serve as the application point of a hook spanner.

Smooth Bore Hose: A wire reinforced hose in which the wire is not exposed in the bore.

Smooth Cover: Cover made to have an even and uninterrupted surface of commercial finish.

Smooth Top (Belt): The cover of a belt made to have an even and uninterrupted surface. Produced by vulcanizing against an even surface such as a press platen of commercial finish.

Soft End: An end in which the rigid reinforcement of the body, usually wire, is omitted.

Softness: Lack of resistance to penetration. Opposite of hardness.

Solid (Packing Ring): Endless.

Spacer: (1) A rigid unattached ring in a packing set serving to prevent excessive deformation of adjacent soft rings. (2) A rigid unattached ring between two piston packings, for instance —two cups back to back.

Spacing: In wire windings in hose (either external or internal) the space between adjacent turns of the wire. Differs from "pitch" in that the diameter or width of wire is not included.

Specific Gravity: The ratio of the weight of a given substance to the weight of an equal volume of water at a specified temperature.

Spider Mark: (1) A cleavage caused by failure of compound to reunite after passing the spoke of the spider in an extrusion machine. (2) Grain produced at point of joining of stock after passing spoke of the spider.

Spiral Lay: The manner in which a spiral reinforcement is applied with respect to angularity and lead or pitch as in a hose or cylindrical article. (See *Angle of Lay.*)

Spliced (Gasket or Ring): Made from a length of extruded coil by joining the ends, either before vulcanization or after.

Spray Oil: An oil sprayed on to asbestos fiber before carding—hence contained in the resultant yarn or fabric.

Spread: A thin coat of material applied in solvent form dispersed or expanded over the surface by means of knife, bar, or doctor blade.

Spread Fabric: Coated with rubber compound by knifing a rubber solution on the surface and drying.

Spring Spreader: A finger spring employed to spread the lips of a U-packing, hat packing, or cup.

Sprue Marks: Marks left on the surface of rubber part, usually elevated, after removal of the sprue of an injection or transfer mold.

Square Braid: (1) Any braid of square cross-section. (2) An 8-carrier braid.

Square Edge: Edge of rubber-covered belting cured against irons which give a square edge to the belt. (Also see *Raw Edge.*)

Square Woven: A cloth or duck having practically the same count or tensile in both warp and fill.

Stack Depth: See *Working Depth,* generally applied to V-rings or cones.

Stack Height: See *Stack Depth.*

Staining: The discoloration imparted to the surface finishes in contact with a rubber product.

Stamp Brand: See *Print Brand.*

Static: Electrical potential charge produced on surface through motion or rubbing rubber against unlike materials.

Static Bonding: Grounding of static eliminating or conducting member.

Static Conducting: Quality or power of conducting or transmitting electrical static charge. (See *Conductivity.*)

Static Elimination: A means for preventing an electrical potential charge or means of dissipating same.

Static Free: Devoid of static.

Static Modulus: The ratio of stress to strain under static conditions. It is calculated from static stress-strain tests, in shear, compression, or tension. It is expressed in psi. unit strain.

Static Proof: See *Static Conducting.*

Static Seal: (General)—See *Gasket.* (Restricted)—A self-tightening gasket.

Static Wire: A wire incorporated in a rubber product to give the quality or additional power to conducting or transmitting static electricity.

Step Joint: (Packing ring)—A Z-shaped cut starting as a butt joint in one face and finishing as a butt joint in the other face at a point not opposite.

Step Ply: A conveyor belt having a plied textile carcass in which the upper ply or plies are set back toward the edges to increase the cover gage in loading area.

Stitched Belt: (1) A belt made from plies of non-rubberized fabric sewed together to make a unit structure. (2) A rubberized belt in which the plies have been sewed.

Stitched Carcass: The body of a product excluding its covers, which has been sewed.

Stitching: (1) A method of butting or joining two pieces of material together, usually by means of a stitcher roller. (2) Sewing.

Straight End: An end with inside diameter the same as that of the main body.

Straight Wrap: A rag wrap applied with the warp of the wrapper parallel to the axis of the hose.

Stress Decay: See *Creep-Relaxation.*

Stress (Packing): Compressive unit load (pounds per square inch) directed against packing by adjacent rigid member, or by the packing against the rigid member.

Stretch: (1) An increase or elongation in dimension. (2) Stress given to belting and fire hose during vulcanization to reduce elongation.

Striated Cover: Drawn or pinched lines generally in the direction of the cover due to drawing or transfer of irregularities from contact with external curing or forming equipment.

Strip Gasketing: Gasketing in strip form.

Strip Method: In fabric testing, a tensile-strength test made on a strip of fabric raveled down to a specified number of threads or width of fabric, all of which are firmly held in grips wider than the test piece. (ASTM Designation D-39)

Strip Packing: See *Strip Gasketing.*

Stripper Cuts: Longitudinal cuts in the cover of lead-press hose caused by an improper setting of the stripper knife used in cutting the lead covering off lead-press hose.

Stuffing Box: A groove or counterbore to accommodate a gasket or a ring set and provided with a gland follower.

Stuffing-Box Gasket: A gasket for use in a stuffing box.

Sub Permanent Set: Strain retained at the end of a finite interval following release of stress.

Sun Checking: Surface cracks, checks, or crazing caused by exposure to direct or indirect sunlight. Sometimes referred to as ozone cracking.

Support Ring: See *Adapter.*

Surface-Graphited: Graphited on surface only.

Surface Resistivity: The electrical resistance of a unit of surface area to a steady current.

Surface Speed: Translational speed of moving member measured at packing interface. Expressed in feet per minute.

Surface Void: A void on the surface of a product. (See *Voids.*)

Swelling: Increase in volume, usually caused by immersion in a liquid.

Swing Joint: See *Swivel Joint.*

Swivel: The free-turning threaded portion of a coupling.

Swivel Joint: A concentric joint between members in limited rotary motion.

T

Tabby: Pick yarns or cords closely woven into strips in woven cord, enabling the woven cord to be cut without the individual cords in the rest of the roll becoming displaced.

Tack: See *Tackiness.*

Tackiness. The property of being tacky.

Tacky (Rubber Surface): Tending to adhere.

Tangent Modulus: In rubber where the static stress-strain line usually is not straight, the slope of the line at any point expressed in psi. per unit strain represents the tangent modulus at that point in shear, extension, or compression as the case may be.

Tangential Joint: (Packing ring)—A cut along a plane parallel to the axis and approximately tangent to the inside periphery.

Tangential Step-Joint: (Packing ring)—A Z-shaped cut starting as a butt joint on the inside periphery and finishing as a butt joint in the outer periphery at a point not opposite.

Tapered End: An end with a progressively reducing dimension.

Tear: To separate or pull apart by force. In measuring tear resistance of rubber, the specimen is usually nicked with a sharp blade; then the force to tear the rubber is measured.

Tear Resistance: The property of a rubber article to resist tearing forces.

Teeth: The tension filaments which appear between two adhering plies of rubber as they are pulled apart.

Tell-Tale Connection: A bleed connection primarily to indicate packing failure.

Temperature: The degree of heat or cold as measured in terms of degrees Centigrade or Fahrenheit.

Template: (1) A gage or pattern used as a guide for cutting or finishing. (2) A gage for measuring purposes, such as "go—no-go" template.

Tension, Effective: In a belt drive, the difference between the two tensions in a belt as it approaches and leaves a driving or driven pulley. In a two-pulley drive, it is the difference between tight and slack side tensions.

Tension, Maximum: (1) The highest tension occurring in any portion of a belt drive. In a two-pulley drive it is the tight side tension. (2) In conveyors, the maximum tension may occur at a point other than the drive pulley.

Tension Modulus: The ratio of the tension stress to the resulting tension strain (the latter expressed as a fraction of the original length). Tension modulus may be either static or dynamic.

Tension Ratio: In a belt drive, tension ratio is the ratio of the larger to the smaller tension as the belt approaches and leaves a driving or a driven pulley. In each case the centrifugal tension is deducted before calculating the ratio.

Tension, Slack Side: In a belt drive, where the two portions of the length of the belt on either side of a driving or driven pulley have different tensions, the slack side tension is the smaller of the two. Slack side tension includes centrifugal tension, unless otherwise specifically stated.

Tension, Slope: (1) The tension in a belt caused by weight independent of friction or other forces. (2) **Belt Slope Tension,** the tension caused by the weight of the belt, independent of friction or other forces. (3) **Load Slope Tension,** the tension caused by the load on the belt, independent of friction or other forces.

Tension, Tight Side: In a belt drive, where the two portions of the length of the belt on either side of a driving or driven pulley have different tensions, the tight side tension is the larger. Tight side tension includes the centrifugal tension, unless otherwise specifically stated.

Thermal Contraction: Contraction caused by decrease in temperature.

Thermal Expansion: Expansion caused by increase in temperature, may be linear or volumetric.

Thickness: (1) The measure of thickness of the complete rubber product. (2) See *Gage.* (3) Gasket or gasketing from which gasket will be cut—axial direction. (4) For packing rings or sets the term *Depth* is preferred.

Thin Cover: A cover the thickness of which is less than specified.

Thin Tube: An inner lining, the thickness of which is less than specified.

Thread: A ridge of uniform section in the form of a helix, on the external or internal surface of a cylinder, or in the form of a conical spiral on the external or internal surface of a cone.

Tie Cloth Breaker: A leno, cider cloth, or cord breaker inserted between belt cover and strength member.

Tight Braid: (1) An unevenness in the braid reinforcement caused by one or more ends of the reinforcement being applied at a greater tension than the balance of the ends of the braided reinforcement. (2) Also refers to a localized necking down of the braided reinforcement caused by a braider stop or some other such cause.

Tongue: An axial extension of one flange joint, partly penetrating a groove in the opposite flange.

Tongue-and-Groove Joint: A flange joint in which one flange is provided with a tongue and the other with a groove.

Top Cover: The protective rubber cover on the material conveying surface or surfaces of a conveyor belt. (See *Bucket Cover.*)

Torque Modulus: See *Instantaneous Modulus.*

Torque (Packing): Moment of rotational friction—i.e., friction times radius of wear face. Expressed in pound-inches total, or per square inch of wear face, or per circumferential inch.

Torsion: (1) Deformation by twisting. (2) The internal restoring couple or twisting moment in a piece of rubber subjected to a twisting motion.

Torsional Vibration: A periodic rotational vibration about an axis.

Traction Top: See *Rough Top.*

Transfer Seam: A seam joining two materials at 90 degrees to the length of the finished product.

Transverse Breaker: See *Transverse Cord Breaker.*

Transverse Cord Breaker: A cord breaker laid in at right angles to the edges of the belt.

Transverse Seam: A seam joining two materials across the width of the finished product.

Trapped Air: Air which is trapped in a product or in a mold during cure. Usually causes a loose ply or cover, or a surface mark, depression, or void.

Trim: The removal of superfluous parts from a molded product. Usually removal of parting line flash or feed sprues.

Trim Cut: Damage to mold skin or finish by too-close trimming.

Tri-Mer: A polymer whose molecule is believed to consist of three molecules of the monomer.

Trimming: Act of removing superfluous parts from a product.

Troughed Diaphragm: A molded diaphragm in which an annular area is depressed below the planes of both rim and center. Designed to permit longer travel than a flat diaphragm of same diameter.

Tube: The innermost continuous all-rubber element of a hose.

Tube Sheet Ferrule: A gasket contained in a stuffing box surrounding a tube where it passes through a tube sheet.

Tube Sheet Gasket: A flange gasket in which one flange is the face of a tube sheet.

Tubular Gasket: A gasket, generally of round cross-section, with a hollow center.

Twist: (1) The turns about its axis, per unit of length, observed in a fiber, roving, yarn, cord, etc. Twist is usually expressed as turns per inch. (2) The turn about its axis of a hose subjected to internal pressure.

U

Ultimate Elongation: Elongation at rupture.

Under Gage: Thinner than the thickness specified.

Undercure: A degree of cure less than the optimum. (See *Cure.*)

Underweight: Under specified weight tolerances.

U-Packing: A sliding packing, operating against any inner or outer reciprocating or rotating member, of a U-shaped cross-section, i.e., with both inner and outer rims axially extended. Less frequently used as a gasket.

Upset End: See *Flanged End.*

V

Valve: A device for controlling shutting off, or diverting the flow of fluid.

Valve Disk: A deformable disk or disk facing, on a poppet valve.

Valve Seat: A deformable seat facing, on a poppet valve.

Valve Stem: A rod or shaft employed to manipulate a valve of any type from a point outside the fluid container.

Valve Stem Packing: Sliding packing employed in contact with a valve stem.

Vanner Edge (Belt): Raised sections on the edges of a rubber belt to prevent loss of material being conveyed.

Vapor Cure: A process for vulcanizing rubber without sulfur inclusion by subjecting the article to the action of sulfur chloride or other curing agents in a closed chamber. It is used generally for thin walled articles.

Vibrational Resilience: See *Dynamic Resilience.*

Viscosity: A manifestation of internal friction opposed to mobility. The property of fluids and plastic solids by which they resist an instantaneous change of shape, i.e., resistance to flow.

Voids: The absence of material or an area devoid of materials where not intended. (See also *Blisters, Bubbles, Sinks.*)

Volume Compressibility: Reduction in physical size effected by imposing a load.

Volume Expansion: Expansion in volume.

Volume Swell: Increase in physical size caused by the swelling action of a liquid.

V-Packing: A sliding packing of V-cross-section, operating against any inner or outer reciprocating or rotating member. Used alone or in sets.

V-Ring: See *V-Packing.*

Vulcanization: Act or process of treating an elastomer or compound of same to improve its useful properties, usually accomplished by application of heat.

Vulcanize: The act of vulcanization. (See *Vulcanization.*)

W

W Packing: A sliding packing of W-cross-section operating against any inner or outer reciprocating or rotating member. Used alone or in sets.

W Ring: See *W Packing.*

Warp: (1) The yarns that run lengthwise in a woven fabric or jacket. (2) The total deviation from a straight line of a hose when subjected to internal pressure.

Warp-Yarn: (1) A longitudinal yarn in a fabric. (2) A corner yarn in a braid.

Washer: (1) An annular disk, usually made of an elastomeric material. (See *Gasket.*) (2) Occasionally same as *Valve Disk,* as in "bib-washer."

Water Absorption: The process of assimilating or soaking up water.

Water Hammer: The concussion or sound of concussion of moving liquid against the sides of a containing pipe or vessel on a sudden stoppage of flow. The most common concussion is that generated by the sudden closure of a valve in a pipe containing a flowing liquid.

Water of Hydration: The water of composition contained in asbestos.

Water Resistant: Withstands the deteriorating effect of water absorption.

Water Seal: A sealing connection introducing water as a sealing fluid.

Waterway: The unrestricted axial orifice through which passes the material to be conducted. (See *Bore.*)

Wave Spring: A ribbon of tempered steel bent into waves. Thrust may be radial or axial.

Wavy Tube: Inner surface of tube showing peaks and valleys as a result of tube showing the braid pattern.

Weak Spot: A limited structural defect in a product which degrades the physical characteristics or strength.

Wear (Sliding Packing): Loss of material from working face.

Weave (Reciprocating Member): Radial displacement during stroke, due to being bent or improperly guided.

Weft: The cross-wise threads in a fabric; filling threads. The threads or yarns running at right angle to the warp.

Weftless Cord Fabric: See *Pickless Cord Fabric.*

Wetting: To form a continuous film of a liquid on a surface.

Whip: Same as *Gyration.*

Wick: A plied roving which may or may not be treated with sizing.

Width: (Gasket or gasketing from which gasket will be cut)—Radial dimension. For packing rings or sets the term *Packing Space* is preferred.

Wiper Ring: A ring employed to remove excess fluid, mud, etc., from a reciprocating member before it reaches the packing.

Wire Braid: A ply of braided wire reinforcement.

Wire-Inserted Asbestos Yarn: Asbestos yarn which has been plied up with one or more metal wires—generally 0.008-inch brass or copper—for added strength.

Wire Looped: A loop in the wire reinforcements due to uneven tensions during braiding, resulting in a bunching of the wire between areas of higher tension.

Wire Reinforced: A product containing metal wires to give added strength, increased dimensional stability, or crush resistance. (See *Reinforcement.*)

Wire Throw-Out: (1) A broken end or ends in the wire reinforcements protruding from the surface of the braid. (2) A displaced coil on rough bore hose.

Wire Winding: A single wire or a plurality of wires spiraled in one or more layers as a protective or reinforcing member.

Wire Wound: A product with a single wire or a plurality of wires spiraled in one or more layers as a protective or reinforcing member.

Wire Woven: Woven with the wire reinforcement applied helically by means of a circular loom.

Wobble: An irregular staggering motion from one side to the other.

Working Depth: Depth of working face, which may be either inside depth or outside depth.

Working Diameter (Diaphragm): One diameter of the unsupported area.

Woven Jacket: A seamless jacket with continuous parallel warp yarns interlaced spirally with continuous filler elements.

Wrap: See *Rag Wrap, Cross Wrap,* and *Straight Wrap.*

Wrapped Cure: Vulcanizing process using a tensioned wrapper (usually fabric) to apply external pressure.

Wrapper: See *Rag Wrap, Cross Wrap,* and *Straight Wrap.*

Wrapper Marks: Impressions left on the surface by the material used to wrap the product during vulcanization. Usually shows characteristics of a woven pattern and wrapper width edge marks. (See *Wrapped Cure.*)

Wrinkle: A corrugation, ridge, crease, or fold in the reinforcement member or the tube or covers.

Wrinkled Cover: See *Wrinkle.*

Y

"y" Value: An empirical design-constant of a flange gasket used in the ASME Code for Unfired Pressure Vessels. The Code defines the term as twice the minimum gasket prestress, but the method of arriving at this value is not clearly stated.

(*Continued on page 775*)

Effect of Arctic Exposure on Hardness of Elastomer Vulcanizates[1]

Ross E. Morris[2] and Arthur E. Barrett[2]

MANY papers have been written regarding the behaviors of various elastomers at low temperatures, but invariably the studies reported were subject to the usual exigencies of laboratory work. Thus, when the test specimens were held at a constant low temperature, the time interval was often quite short, and when the temperature of the specimens was changed at a constant rate from a high value to a low value, or *vice versa,* the rate was quite rapid. The long exposure interval and the slow rate of temperature change, characteristic of rubber items subjected to arctic weather, are seldom, if ever, attained in laboratory testing.

In order to obtain objective information on the behavior of vulcanized elastomers in the Arctic, this laboratory took advantage of an opportunity to have rubber specimens exposed to weather at the Navy's Arctic Test Station, Point Barrow, Alaska. Point Barrow lies within the Arctic Circle, at a latitude of 71° N.

Fig. 2. Racks for Holding Specimens at Point Barrow, Alaska

TABLE 1. RECIPES OF NATURAL RUBBER STOCKS

	A	B
Smoked sheet	100	100
Pelletex*	2	2
Zinc oxide	5	5
Stearic acid	1	1
Cottonseed oil	12	2.5
Heliozone†	3	3
AgeRite Resin D‡	2	1
Santocure§	0.6	
DPG	0.4	
Captax‡		0.5
Altax‡		0.5
Methyl Tuads‡		0.5
Sulfur	2.5	0.75

Cure: 20 minutes at 290° F.

TABLE 2. RECIPES OF NEOPRENE STOCKS

	C	D	E
Neoprene GN	100		
RT		100	
W			100
P-33‡	30	30	30
Zinc oxide	5	5	5
XLC magnesia	4	4	2
Stearic acid	1	1	1
Circo light process oil¶	20	20	10
Paraffin	2	2	
Neophax A‖	5	5	
Neozone A†	2	2	2
Thionex†			0.5
Sulfur	1	1	1

Cure 60 minutes at 310° F.

TABLE 3. RECIPES OF GR-S STOCKS

	F	G
GR-S 1002	80	80
1000	20	20
Philblack A**	40	40
Zinc oxide	5	5
Heliozone†	1	1
Di-n-hexyl adipate	20.2*a*	
Para Flux††		22.3*a*
Methyl Tuads‡	1	1
Sulfur	1	1

Cure: 20 minutes at 310° F.

*SRF black, Herron Bros. & Meyer, New York, N. Y.
†E. I. du Pont de Nemours & Co., Inc., rubber chemicals division, Wilmington, Del.
‡R. T. Vanderbilt Co., New York, N. Y.
§Monsanto Chemical Co., rubber chemicals sales, Akron, O.
¶Sun Oil Co., Philadelphia, Pa.
‖Stamford Rubber Supply Co., Stamford, Conn.
**MAF black, Phillips Chemical Co., Akron.
††C. P. Hall Co., Akron.
*a*20.2 volumes per 100 volumes of rubber.

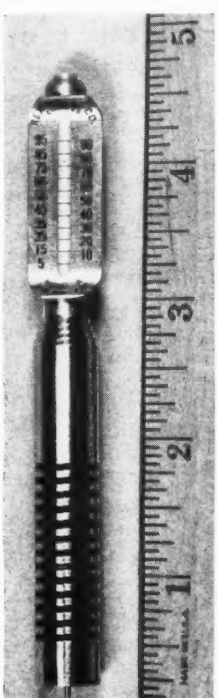


Fig. 1. Rex Hardness Gage

The type of testing to be performed on the rubber specimens at Point Barrow could not be complicated, since the available personnel had no previous experience with rubber testing, and there was no opportunity to instruct them, except by letter. It was decided that measurements of hardness using the Rex gage,[3] Figure 1, would be the simplest and most precise test under the circumstances. The hardness reading on a Rex gage is nominally the same as the "instantaneous" reading on the Shore A durometer.

Details of Testing

The elastomers to be tested were compounded and molded into one-by-three-inch slabs, ¼-inch thick. These slabs were fastened to aluminum plates without placing the rubber under strain. The aluminum plates with attached specimens were mounted on racks at Point Barrow and left there for two years, March, 1950, to February, 1952, inclusive.

Figure 2 shows the racks at Point Barrow before the specimens were mounted. The Station personnel were requested to measure the hardness of the specimens on the sixth day of every month at approximately 8:00 a.m. and record the air temperature at the exposure location at this time together with maximum and minimum temperatures occurring during the 24-hour period just prior to the time of measuring the hardnesses.

The elastomers selected for testing were natural rubber, three types of neoprene, and GR-S. The recipes used are given in Tables 1, 2, and 3, respectively. They are typical of recipes for medium-soft gasket stocks. Two

[1] The opinions or assertions in this article are those of the authors and are not to be construed as official or reflecting the views of the Navy Department or the Naval Service at large.
[2] Rubber laboratory, Mare Island Naval Shipyard, Vallejo, Calif.
[3] ASTM Tentative Method of Test D676-49T. "ASTM Standards on Rubber Products, December, 1952." American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

natural rubber stocks were tested which differed primarily in the proportion of sulfur in the recipe. One stock contained a normal proportion of sulfur, 2.5 parts; the other stock contained a low proportion of sulfur, 0.75-part. Three neoprene stocks were tested, each compounded with a different type of neoprene: namely, GN, RT, and W. Thirty-nine GR-S stocks were tested. All GR-S stocks had the same recipe except for the plasticizer contained. In this report only the stock containing di-n-hexyl adipate and the stock containing Para Flux will be considered. These are representative of the best and poorest stocks, respectively, for hardness change in arctic weather.

Results of Tests

The results of hardness and cold compression set tests,[4] performed on the foregoing stocks in the laboratory, are presented in Table 4. The hardness data seem to indicate that both natural rubber stocks and the GR-S stock containing di-n-hexyl adipate are outstanding for softness at low temperatures. However, the cold compression set datum for the natural rubber stock containing a low proportion of sulfur, shows that this stock crystallized at —35° F. and therefore might have suffered a considerable increase in hardness at —20 and —40° F. if the conditioning interval for the latter tests had been extended.

TABLE 4. RESULTS OF LABORATORY TESTS

Stock	Elastomer	Rex Hardness*— @ °F. +82	+20	0	−20	−40	Cold Compression Set†—%
A	Natural rubber (2.5 pts sulfur)	35	37½	35	45	47½	34
B	Natural rubber (0.75-pt sulfur)	35	40	35	40	50	102
C	Neoprene GN	47½	52½	52½	82½	90	48
D	Neoprene RT	45	52½	55	77½	90	43
E	Neoprene W	40	75	85	85	92½	67
F	GR-S (di-n-hexyl adipate)	50	50	50	57½	60	27
G	GR-S (Para Flux)	45	57½	57½	75	85	68

*Measured after specimen had been conditioned for 16 to 20 hours at temperature indicated.

†Measured 30 minutes after release from clamps at −35° F. Specimens had been held at 40% compression for 94 hours at −35° F.

In view of the known tendency of neoprene stocks to crystallize at low temperatures[5] it may seem surprising that the neoprene stocks studied here did not have higher compression set values at —35° F. The explanation resides in the fact that the crystallization rates of the neoprene stocks were decreased both by the sulfur in the stocks and by the low temperature itself. A Neoprene GN vulcanizate containing one part of sulfur crystallizes most rapidly at about 0° F., as shown by the data in Table 5.

TABLE 5. EFFECT OF SULFUR CONTENT AND TEMPERATURE ON COLD COMPRESSION SET OF NEOPRENE GN VULCANIZATE

Sulfur content, PHR	0	0	1	2	3
Conditioning time, days	4	7	4	4	4
Compression set at −40° F., %	70	75	75	80	85
−20° F., %	65	94	41	37	34
0° F., %	95	99	61	45	37
+20° F., %	97	98	38	28	24
+40° F., %	39	50	19	18	17

STOCK USED IN THESE TESTS

Neoprene GN	100
Thermax*	20
Zinc oxide	1
XLC magnesia	4
Paraffin	2
Neophax A†	10
Stearic acid	1
Circo light process oil‡	15
Neozone A§	2
Sulfur	variable

Cure: 80 minutes @ 310° F. for stocks containing 0 and 1 part sulfur.
60 minutes @ 310° F. for stocks containing 2 and 3 parts sulfur.

*MT black. R. T. Vanderbilt Co.
†Stamford Rubber Supply Co.
‡Sun Oil Co.
§Du Pont rubber chemicals division.

These data were obtained using a Neoprene GN stock of slightly different composition than the stock employed in the weathering tests reported here. The significant point in Table 5 is the higher compression set value obtained at

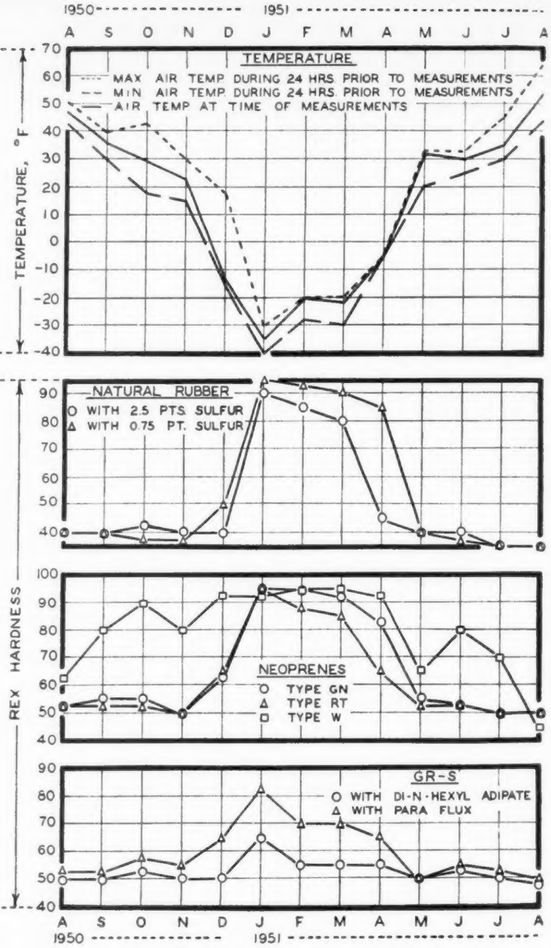


Fig. 3. Air Temperature and Hardness of Specimens at Point Barrow

0° F. than the values obtained at —20 and +20° F. in the case of the one-part sulfur stock. The high compression set of this stock at —40° F. is largely due to the nearness of this temperature to the second-order transition temperature of Neoprene GN.[6]

The Rex hardnesses and the concurrent temperature data for the specimens in the Arctic are plotted in Figure 3. Only the data taken during the period August, 1950, to August, 1951, are shown. The lowest temperature recorded during this period was —40° F., in January, 1951. This was the minimum air temperature during the 24 hours prior to making the hardness measurements. The corresponding temperature at the time of making the hardness measurements was —35° F.

Figure 3 shows that the GR-S stock plasticized with di-n-hexyl adipate was outstanding for cold resistance, and that even the GR-S stock plasticized with Para Flux was better than the natural rubber and neoprene stocks tested. The latter stocks apparently had crystallized to some extent in view of their slower response to rising temperature, particularly between January and February, 1951. The Neoprene W stock was particularly poor in this respect.

Examination of the plotted data for finer differences than those pointed out above shows that the natural rub-

[4] R. E. Morris, J. W. Hollister, P. A. Mallard, India RUBBER WORLD, 112, 455 (1945).
[5] N. Catton, "The Neoprenes." E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. (1953).
[6] L. A. Wood, "Advances in Colloid Science, Volume II." Interscience Publishers, Inc., New York (1946).

her stock with normal sulfur had better low-temperature behavior than the stock with low sulfur, and that the Neoprene RT stock excelled somewhat the Neoprene GN stock. The first relation was to be expected in view of the fact that crystallization is hindered by sulfur cross-links.[6] The second relation follows from the known slower rate of crystallization of Neoprene RT.[5]

Laboratory Testing *vs.* Arctic Testing

It is interesting to compare the laboratory measurements of Rex hardness given in Table 4 with the plotted data in Figure 3. The hardnesses of the stocks at —20° F. have been abstracted from these sources and are given in Table 6. The stocks are listed in Table 6 in order of increasing hardness according to the laboratory measurements. It will be noted that the laboratory hardness tests gave an entirely false idea of the behavior of the natural rubber stocks in the Arctic. From the laboratory hardness tests it would be assumed that these stocks would retain most of their softness in the Arctic. Actually, they were about 40 points harder at —20° F. in the Arctic than they were at —20° F. in the laboratory. The difference, of course, was due to crystallization of the elastomer during the long interval at low temperatures in the Arctic.

TABLE 6. REX HARDNESS AT −20° F.

Stock	Elastomer	Rex Hardness at −20° F. In Lab.	Rex Hardness at −20° F. In Arctic
B	Natural rubber (0.75-pt sulfur)	40	92½
A	Natural rubber (2.5 pts sulfur)	45	85
F	GR-S (di-n-hexyl adipate)	57½	55
G	GR-S (Para Flux)	75	70
D	Neoprene RT	77½	87½
C	Neoprene GN	82½	95
E	Neoprene W	85	95

The conditioning interval for the hardness tests in the laboratory, 16-20 hours, was not of sufficient duration for much crystallization to occur. In this connection it will be remembered that the cold compression set datum in Table 4 predicted the crystallization of the natural rubber stock containing low sulfur.

The behaviors of the neoprene stocks in the Arctic were foretold to a closer degree by the laboratory hardness tests; however, even these stocks were about 10 points harder in the Arctic owing to crystallization. Only in the case of the GR-S stocks, which did not crystallize, was good agreement obtained between hardness measurements in the laboratory and in the Arctic.

Conclusions

It is concluded that the results of hardness tests of elastomer vulcanizates after they have been conditioned for short intervals at low temperatures are not always a true measure of the hardnesses which the vulcanizates will attain in the Arctic. It is further concluded that GR-S is a better elastomer for compounding stocks to be used in the Arctic than natural rubber, Neoprene RT, Neoprene GN, and Neoprene W.

Acknowledgment

The cooperation of the personnel at the U. S. Naval Arctic Test Station, Point Barrow, Alaska, is gratefully appreciated. The authors also wish to express their appreciation to T. A. Werkenthin, of the Bureau of Ships, for his assistance in arranging for the aging of the specimens at Point Barrow.

Glossary of Terms

(Continued from page 772)

Yarn: A generic term for continuous strands of textile fibers or filaments in a form suitable for knitting, weaving, or otherwise intertwining to form a textile fabric. It may comprise: (a) a number of fibers twisted together, (b) a number of filaments laid together without twist (a zero-twist yarn), (c) a number of filaments laid together with more or less twist, or (d) a single filament with or without twist (a mono-filament).

Yield Point: The stress in a material, at which there occurs a marked increase in strain without an increase in stress. Rubber is said to have a zero yield point except under very rapid elongation and release.

Yield Strength: The stress at which a material exhibits a specified limiting permanent set. Determined by a measurable value of plastic yielding of the material above which the material is considered to be damaged and below which the damaging effects are considered to be negligible.

Young's Modulus of Elasticity: (1) In many non-rubber materials Young's Modulus may be taken in tension or compression; the values are approximately the same. It is the ratio of stress to strain, expressed in psi. per unit strain. (2) In rubber, the assumption that tension modulus equals compression modulus is valid only for extremely small deformations and for certain shapes such as specified in ASTM D-797, "Standard Method of Test for Young's Modulus in Flexure of Natural and Synthetic Elastomers," and ASTM D-1053 (Sec. 7), "Measuring Low-Temperature Stiffening by the Gehman Torsional Apparatus."

Z

Zero Load: A minor load applied to sheet material in the course of getting initial thickness reading and prior to determining compressibility.

Polyethylene Submarine Cables

TWO applications of polyethylene as insulating material for underwater cables have been made public. The first, a telegraph line extending some 1,758 nautical miles between Recife, Brazil, and the Cape Verde Islands, replaces the link that was lost in World War II and again makes possible direct communications between South America and Rome, Italy. The second is a coaxial telephonic cable which extends 1,000 miles from Florida into the Caribbean and connects an Air Force system of radar stations used to track guided missiles. Both cables are insulated with polyethylene manufactured by Bakelite Co.

The new link between Brazil and St. Vincent Island off the west coast of Africa is a one-inch cable, insulated with polyethylene instead of gutta percha, which made possible a smaller diameter, lighter weight product that is less expensive to manufacture and more efficient in operation. The decreased weight and low dielectric constant of polyethylene cut the cable cost approximately 37%; the latter permitted the use of 25% less copper wire. Savings in the quantity of steel wire, jute yarn, and jute twist employed were also realized as a result of the use of the plastic.

Also, the new cable is more efficient than its predecessor, transmitting at least 300 letters a minute, as compared to a maimum rate of 270 letters a minute for the gutta-percha type.

Italcable, owner of the telegraph line, had parts of the new link manufactured in four European countries. Laying was completed in little over a month with the help of a specially designed ship. Almost 98% of the cable lies well over 2½ miles beneath the surface, at one point attaining a depth of 3¾ miles.

The telephone cable of the Air Force also attains depths of more than two miles. Supersonic guided missiles fired from the Florida base radio performance information to the observation posts which relay these data back to a central control post on the mainland. The insulating compound used on this cable was developed by Bell Telephone Laboratories, Inc., and is based on a high molecular weight polyethylene resin.

Editorials

U. S. - Latin American Rubber Research Program in Danger

A VERY important program of research and development on natural rubber in Central and South America, instituted in 1940, with the United States and 14 Latin American countries participating, is facing curtailment unless Congress will grant an appropriation of $300,000 to continue the research part of the program. Rubber industry leaders are urged, therefore, to encourage action by the Congress on this appropriation.

This natural rubber research and development program, which has as its primary purpose the development of blight resistant, high-yielding trees as a prerequisite for the establishment of commercial plantings in this hemisphere, is very near completion. A detailed description of the original program was published in our June, July, and August, 1942, issues. A recent estimate of the cost of the program for the 1953 fiscal year shows a total figure of nearly $2 million, of which the United States contributes about $600,000, and the Latin American countries the remainder.

The present difficulty has arisen out of a technicality in that the Foreign Operations Administration, now responsible for the project as a part of the Government's Technical Assistance Program, indicated recently that it could not continue to supply money for the research part of the program, although it would supply about $300,000 a year for development work. The Foreign Operations Administration is restricted by its charter to providing technical assistance and cannot support basic research projects as such.

At a meeting in Washington on February 11, Everett G. Holt, assistant director, Chemical and Rubber Division, Business and Defense Services Administration, U. S. Department of Commerce, called together representatives of the Office of Defense Mobilization, the Agriculture Department, FOA, and industry to exchange views on how to continue the research program for the coming fiscal year.

The industry representatives strongly supported the position of the Agriculture Department, which has been in charge of the work for the FOA, that the research and development aspects of the program must be kept together. It was tentatively decided that the Agriculture Department should make the request for the necessary appropriation.

There are many reasons why it is necessary that this relatively small appropriation be approved. In this work, as in future research and development work on synthetic rubber, basic research is essential to support development work. The problems of the program are reported to be near solution, and the research workers, who have labored on them for almost 14 years, are an invaluable part of the program and should not be transferred to other work. The results of the program will benefit the whole rubber industry in this country as well as the several Latin American countries involved. The Far Eastern natural rubber industry, which could not survive an attack of leaf blight, will also benefit substantially by a continuation of this research and development work.

In addition, the successful completion of this program on natural rubber would provide the basis for the "living stockpile" in this hemisphere, as proposed just about two years ago by P. W. Litchfield, chairman of the board, Goodyear Tire & Rubber Co. His company is one of those that has been participating with the Department of Agriculture and the 14 Latin American countries since the beginning of the program.

Two years ago Litchfield pointed out that the annual cost of maintaining a five-year stockpile of natural rubber in this country at an average cost of the rubber of 45¢ a pound was approximately $28 million. Of course, with present-day prices the cost would be about half that amount. He added that experience gained at the Goodyear plantation in Costa Rica indicated that 300,000 acres of new planting and development up to the point of tapping the trees would cost about $100 million, spread over a six- or seven-year period. The acreage would yield 150,000 long tons of natural rubber annually on a self-liquidating basis, with the probability of a substantial return on the investment.

It would seem desirable to reexamine the Litchfield proposal in connection with the continuation of the research and development program on natural rubber in Central and South America. There are also many reasons to believe that a "living stockpile" would be preferable to the existing stockpile. Not only would the former have many advantages from a national security viewpoint, but the natural rubber trees would be more disease resistant than those in the Far East, as a result of the Latin American program.

The first and most important action required at this time, however, is to make sure that the Congress receives and approves the Agriculture Department request for an appropriation of $300,000 to continue the research part of the Latin American program for the coming fiscal year. It is here that the industry can help by contacting its representatives in the Congress and making sure that the importance of this relatively small appropriation request is realized.

R. G. Seaman

DEPARTMENT OF
PLASTICS TECHNOLOGY

Injection Molding of Elastomeric Vinyls—II[1]

Frank A. Martin[2]

THE following installment concludes the informative article on the injection molding of elastomeric vinyls which was begun in our February, 1954, issue.

Preplasticizing Screw-Type Machines

From our work at the Hoover Co. we are convinced that, while restricted gating may be worked out for individual molds to give satisfactory pieces, plasticizing action should come in the injection machine rather than in the mold. We, therefore, investigated the preplasticizing screw type of machine, since industry-wide experience in the extrusion of elastomeric vinyls has shown that a screw-type extruder does an excellent job of plasticizing PVC.

In that type of machine the plasticizing action comes from two sources: externally applied heat and frictional heat generated in the material by the mechanical working of the material. In fact, it is necessary in most cases, when vinyl elastomers are being extruded, to provide means of removing the excess frictional heat. The gloss and the surface finish of extruded goods are ample proof of the fact that the screw machine does a very good plasticizing job. The extruder has the further advantage in that the screw moves all of the material forward and out of the hot barrel, so that there is little opportunity for a material to lodge and decompose. Therefore a combination of a screw-type plasticizing machine with an injection molding unit should be the ideal machine for injection molding of vinyls.

Such a machine employing the Hendry screw preplasticizing principle has been on the market for several years. One of these machines has been running for more than two years, molding vinyl distributor-cap nipples. On this job the cycle was shorter than on a conventional machine, and the gloss and the surface were better. Figure 4 shows a view of the plasticizing section of this type of machine.

Preplasticizing by means of an extruder offers a great many advantages. First of all, the screw does a much better plasticizing job than can be obtained by pushing material through a heated cylinder containing a spreader. There is ample experimental evidence to confirm this fact. The thoroughly plasticized material produces molded

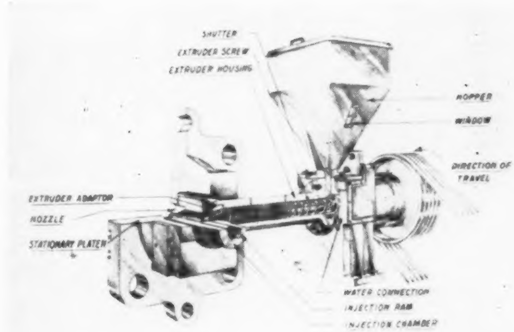


Fig. 4. Cross-Sectional View of Plasticizing Section of Screw-Type Preplasticizing Injection Molding Machine

parts with better surface finish and gloss and with freedom from cold spots and splash marks.

The screw preplasticizing machine can be operated at much lower temperatures than conventional machines. Typical vinyl compounds can be molded at 250° wall temperatures in the extrusion chamber and injection chamber. Frictional heat does bring the material temperature up to approximately 320° F., at which point it is in an ideal state to mold. Since the metal walls with which the material comes in contact are well below the temperature at which decomposition is appreciable, the danger of burning material is practically eliminated. Also, the self-cleaning design of the screw and better streamlining of the injection chamber through the elimination of the spreader preclude the possibility of material remaining in contact with the hot metal walls long enough to start burning.

One of the big advantages of the screw-type, preplasticizing machine lies in its increased plasticizing capacity. It has usually been found that the molding time is established by the time required to plasticize sufficient material for the mold charge rather than by cooling time in the mold.

By way of example, in running a nine-ounce shot on a conventional 12-ounce injection machine, the overall molding cycle averaged 135 seconds. The parts were sufficiently cold to be removed from the mold in 30 seconds; yet the cycle could not be reduced because after a few shots the material was too cold to mold. Nor could

[1] Presented before the Buffalo Section, Society of Plastics Engineers, Inc., Buffalo, N. Y., Oct. 16, 1953.
[2] The Hoover Co., North Canton, O.

the temperature be increased to compensate for shorter cycles without starting to get thermal decomposition. Under these particular conditions the plasticizing rate of this 12-ounce machine was calculated to be only 18 pounds of vinyl material per hour. In contrast, the plasticizing rate of one of the 16-ounce, screw-type, preplasticizing machines with a 2½-inch screw on the same material was found to be 60 pounds per hour, an increase of 233% for an increase of only 33% in rated machine capacity. Without a doubt further increases in plasticizing capacity can be obtained under optimum conditions, since similar material is often extruded from a 2½-inch extruder at a rate of more than 100 pounds per hour. Therefore the overall molding cycles can be greatly shortened because of the increased plasticizing or melting capacity of the machine.

The screw preplasticizing unit has a still further advantage over conventional machines for molding soft vinyls. The screw is so designed as to give maximum compounding action; so it is unnecessary to use compounded material for molding. By definition, compounded material here refers to granules of compound produced by fluxing the resin, plasticizer, stabilizer, color, etc., either in a heated Banbury-type mixer or on a two-roll mill; sheeting; and then dicing or granulating. In contrast to this compounded or granular material, the screw-type machine will mold material prepared by mixing all the ingredients in a ribbon-type mixer until a dry, free-flowing powder results. The ability of the screw-type machine to mold dry blends results in a number of advantages. First of these is a large reduction in material costs. In addition, the preblend, having a much lesser heat history, should be able to withstand more additional processing or end-use heat than granular material.

The technique of making dry blends and molding them on conventional injection machines will be discussed a little later. One additional big advantage of the screw preplasticizing machine seems to be that the size and the location of the gate are much less critical, since we do not rely on the gate to furnish part of the plasticizing action.

There are also some disadvantages in connection with using the screw preplasticizing type of machine. This machine is more expensive, but not unreasonably so when consideration is taken of the fact that it is in reality two machines, an injection machine and an extruder. There are temperature-control problems arising from the frictional heat generated in the screw but these can be solved by application of extrusion techniques on similar materials. As with any type of preplasticizing machine where the injection plunger pushes on hot, soft material, there is some leakage of material back along the plunger. This leakage can be brought under control if plunger and cylinder liner are constructed from materials which can be run at relatively close clearance without scoring.

The theory of screw preplasticizing is also attracting attention abroad. R. H. Windsor, Ltd., in England, has announced a new molding machine utilizing its twin-screw extrusion system as a preplasticizer for injection molding. This machine, instead of extruding the plasticized material into an injection chamber from which it is transferred to the mold by a plunger, utilizes a forward movement of the screws themselves to push the material into the mold.

Molding of Dry Blends—Conventional Machines

I have already mentioned briefly the idea of molding dry blends. Dry blends are commonly made in jacketed ribbon blenders which have an internal spray pipe for injecting the plasticizer. Mounted above the blender is

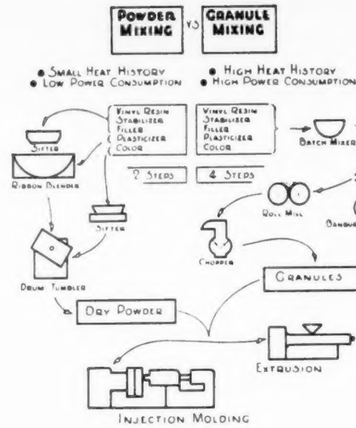


Fig. 5. Comparison of Dry Blend (Powder Mixing) and Granule Mixing Processes

a rotary brush sifter through which all the dry ingredients pass. The dry materials are loaded to the sifter by means of a conveyor from the weighing station.

In making a dry blend the general procedure is to load the resin, pass steam into the blender jacket, and heat the resin to 175° F., then add the preheated plasticizer through the spray pipe, and continue heating until the batch dries out. Stabilizers may be added with the resin or plasticizer. Colors should go in with the resin if they are to be blended. The batch will be dry when the temperature reaches 200-220° F., at which point the steam is shut off, and cold water started through the jacket. Fillers are added at this point, and mixing continued until the temperature is lowered to approximately 140° F. The batch is dumped into the hopper, from which it is weighed into drums. Color may also be added by tumble mixing in the drums. This procedure is a typical dry blending one. Times and temperatures will vary for different types of compounds. The complete mixing cycle may run from 60 to 120 minutes.

A typical dry blend recipe is shown in Table 1.

TABLE 1. TYPICAL DRY BLEND RECIPE

Components Blended by Molder		Pounds	Cost
PVC Resin	@ 38¢/lb.	100	$38.00
Plasticizer	@ 35¢/lb.	50	17.50
Filler	@ 3¢/lb.	35	1.05
Stabilizer	@ 30¢/lb.	5	1.50
Lubricant	@ 25¢/lb.	0.5	.13
		190.5	$58.18

$\frac{\$58.18}{190.5} = 30.5¢/\text{lb.}$

Processing 2¢
Color 1-2¢

TOTAL 33.5 - 34.5¢

A comparison of processing dry blends *vs.* granular compounds is shown in Figure 5. The dry blend is made in one step (two if color is added later by tumbling), utilizes low-cost equipment, and has a low heat history. The granular compound takes four steps to produce on high-cost equipment and has a high heat history. The raw material cost for both processes is the same. A typical example of dry blend shown in Table 1 costs 30.5¢ for materials, plus 2¢ maximum for processing, plus 1¢ to 2¢ for color. The same grade of compound purchased from a material supplier in granular form would be 40 to 45¢ per pound.

Obviously, the capital equipment investment for making dry blends is much less than for Banbury or mill mixing followed by granulation. Blending equipment may be installed for approximately $5,000 to $10,000. Ban-

bury and mill mixing equipment on a comparable scale would run $75,000-100,000. Processing cost for a dry blend is estimated at 2¢ per pound maximum; while processing cost for granular compounds is 4¢ to 8¢ per pound. However a molder can make his own dry blend for 8¢ to 10¢ per pound less than he can buy it in granular form from a material supplier.

The molded dry blend will have the same physical properties as molded granular compound of the same composition. The dry blend has another distinct advantage over the Banbury mixed stocks. The heat history is very much less—the maximum processing temperature for dry blends is 225° F., compared to 320-350° F. for the granular processes. Since the ultimate decomposition of PVC is a result of the cumulative time-temperature heat history, the dry blend has much more heat life left in it and will therefore stand higher molding temperatures.

With that brief summary of the vinyl dry blends as materials, we can discuss what is being done in the way of molding dry blends on conventional machines. For this development, which is very recent, we must give credit to Monsanto Chemical Co. for pushing molders into trying it. Their dry blend molding is essentially similar to the molding of styrene, acetate, or polyethylene with the following exceptions:

1. Folding temperatures are generally below 400° F.
2. Application of heat alone is not sufficient to melt or fuse the dry blends. They should be worked or compounded in the cylinder.
3. Since the materials are flexible, they may be removed from the mold at elevated temperatures without permanent distortion. This factor permits shorter molding cycles.

Dry blends are now being molded in most makes of injection machines of four- to 16-ounce capacity. Multiple heating zone controls are desirable on the cylinder, and conventional steel cylinders are usually employed, but for continuous molding of PVC, corrosion resistant cylinders are preferred. As mentioned previously, heat alone does not sufficiently plasticize PVC materials and should be augmented by a mechanical action. This action can be obtained to some extent in the torpedo, and a torpedo design with a drilled sleeve will aid in the plasticizing action. Designs which do not tend to restrict the flow are less efficient in compounding vinyls, but also they are more subject to causing material to hang up and burn; so generally a compromise design must be used.

To aid further in the compounding action a dispersion disk or breaker plate should be used in the nozzle. This disk should be ¼-inch thick with 0.050-inch diameter holes uniformly spaced over the surface. The design of the disk and style of holes are best determined by trial. Nozzle temperature plays an important part in molding of dry blends and should be capable of close control either by a rheostat or potentiometer type of instrument.

Some difficulties may be encountered in the feeding of dry blends from hoppers. It may be necessary to modify the hopper, or use a coarse screen in the throat in conjunction with a vibrator.

Molding temperatures vary with the compound being used. Temperature requirements will range from 350 to 400° F., with highly plasticized formulations molding at lower temperatures than the harder compounds. Our limited experience with molding dry blends in conventional machines has indicated that the dry blends require and will stand without decomposition higher cylinder temperatures than granular compounds of the same hardness. We have molded dry blends at a temperature of 425° F. for two to three hours without decomposition. This procedure certainly supports the claims of greater heat stability because of the lesser heat history.

Usually a temperature differential of 20 to 40° F. is maintained between the front and the rear sections of the cylinder. When the dispersion disk is used, the mechanically generated heat makes it difficult to establish a temperature equilibrium in the front section. The nozzle temperature should be rather high; up to 400° F. is satisfactory.

Mold temperatures should be in the range of 125 to 150° F. and are generally not critical. Warm molds tend to give better gloss; while low mold temperatures may cause flow lines and lamination.

Other Molding Problems

The combination of poor thermal stability and low thermal conductivity make it expedient to derate the injection machines. By the designing of the molds to take volumes substantially under the rated machine capacity the material takes longer to go through the heating cylinder; so fairly good plasticizing action is obtained. Derating also permits the use of lower temperatures, thereby lessening the danger of degradation.

Another common problem encountered is back-rinding, in which excessive shrinkage at the gate causes the part to pull back into itself. This condition may generally be eliminated by control of the plunger time. Short dwell time is usually better since material is not packed in the gate area to cause excessive strains.

The estimation of shrinkage for use in establishing mold size also imposes a problem. Shrinkage varies with the amount of plasticizer and filler in the compound and with molding conditions. It will run from 1% to 3%, generally falling between 1.5 and 2.5%. Fortunately, the majority of applications for elastomeric PVC moldings does not require exacting control of finished dimensions, since these materials are used because they have the property of elasticity.

Still another problem is the difference in plasticizing rate from one shipment of material to another. Changes in temperatures and cycles are frequently required from shipment to shipment of the same compound. Since temperatures are rather fixed as to the upper limit which may be used without degradation of the material, the changes are generally made in the time cycle. Over a period of years on a given job we have found it necessary to vary cycles by as much as 105%.

Summary and Conclusions

By way of conclusion, I believe that the molding of elastomeric vinyls offers a fertile field to the custom molder. The surface of this field has only been scratched. These materials can compete with rubber in many applications and bring to those applications the plus factors of better appearance, better aging, and lower costs.

Numerous troublesome factors are involved in molding PVC; most of these factors stem from the poor thermal stability and low heat conductivity which make uniform plasticizing action difficult to obtain. However the use of restricted flow techniques in the nozzle and gates to generate flash heat aids materially in the plasticizing problem. The screw preplasticizing type of machine promises to give the desired plasticizing action with freedom from thermal decomposition and at a greatly increased rate. Dry-blend compounds mixed in the molder's plant offer a big savings in material cost, and increased safety as regards burning. These dry blends are readily handled by the screw-type plasticizing machine and can also be molded in slightly modified conventional machines.

I predict that the next several years will see greatly increased activity in the molding of elastomeric PVC. With this increased activity will come new techniques in compounding and in molding.

Meetings and Reports

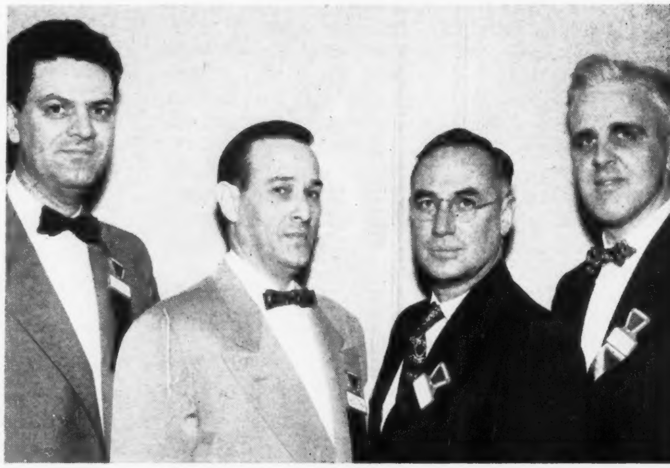
SPE "International" Conference Sets New Attendance Record

A NEW record attendance of more than 1,100 members and guests was reached at the tenth annual National Technical Conference of the Society of Plastics Engineers, Inc. The first "international" meeting of the series, the Conference took place at the Royal York Hotel, Toronto, Ont., Canada, on January 27-29.

As in previous years, the main feature of the three-day meeting was the technical program which consisted of morning concurrent sessions on January 28 and 29, and afternoon sessions on all three days. In addition, the meeting included the Society's annual banquet on January 28, the annual luncheon on January 29, and a comprehensive ladies' program that included luncheons, demonstrations, fashion shows, and tours.

New National Officers

New national officers of the Society for the coming year, elected by the national directors, were announced at the banquet, as follows: president, John W. LaBelle, Foster Grant Co.; vice president, Don F. Hoffman, Evans-Winter-Hebb, Inc.; secretary, Frank W. Reinhart, National Bureau of Standards; and treasurer, John W. Mallory, Parker Stamp Works. The executive secretary is Paul J. Underwood who was appointed to the office in mid-1953.



New SPE National Officers *(Left to Right)* Secretary, Frank W. Reinhart; Vice President, Don F. Hoffman; President, John W. LaBelle; and Treasurer, John W. Mallory

Annual Banquet and Luncheon

Walter F. Oelman, Standard Molding Corp. and outgoing national SPE president, presided over the gala banquet. Mrs. Bess R. Day, the previous executive secretary, was presented with a silver service and an honorary life membership in the Society in token for her services to the organization. Mr. LaBelle made the presentation of the customary plastic gavel to Mr. Oelman as a memento of his term of office.

The after-dinner speaker was Dr. Emmett O'Grady, Ottawa University, who gave an interesting talk on "Levity and Learning in Literature." Following the banquet there was an evening of dancing in the Imperial dining room.

The luncheon on January 29 incorporated the Society's annual business meeting. Mr. Oelman reported on progress during the past year and on plans made by the national directors for the coming year. Committee reports were also heard, as follows: education, Jules W. Lindau, III, University of South Carolina; publications, Jesse H. Day, *SPE Journal;* membership, Joseph P. Healey, Manco Products, Inc.; and executive office, Mr. Underwood. Mr. Healey announced that the Society now has 3,201 members, with 73 new applications received at the Conference. In the absence of Richard W. Bruce, Bakelite Co. and outgoing national treasurer, the treasurer's report was read by W. O. Bracken, Hercules Powder Co.

Abstracts of Papers

Abstracts of nine of the technical papers were given in our January issue, page 496. The remaining abstracts follow:

WEDNESDAY, JANUARY 27

"Techniques and Applications of Modified Polystyrene Sheet (475)," F. J. MacRae and W. D. Harris, both of Dow Chemical Co. The introduction of modified polystyrene in sheet form has established a new field of plastics fabrication. The bulk of such sheet is fabricated by vacuum forming. The low costs of this process make fabrication attractive for many users and applications. Research for more versatile sheet materials and techniques is expected further to stimulate the growth of sheet fabrication.

"Applications for Rubber Modified Styrene Molding Compounds," E. D. Hellyar, Monsanto Chemical Co. The introduction of rubber modified styrene molding compounds has resulted in an overall expansion of the total styrene market. These materials, widely used in industrial applications, are rapidly replacing general-purpose styrene in housewares and toys where their better impact properties provide consumer appeal. New developments in materials and equipment are in process, and a doubling of sales of impact styrenes is expected within the next five years.

"Acrylonitrile Copolymer Blends in Pipe and Fittings," P. M. Elliott, Naugatuck Chemical Division, United States Rubber Co. The speaker discussed the properties, advantages, methods of extrusion, and applications of acrylonitrile copolymer pipe. Plastic-pipe sales volume in 1952 was almost $18,000,000 and is estimated at $25,000,000 for 1953. This latter figure is expected to be increased tenfold by 1963.

"Present and Future Applications of Heat Resistant Modified Styrenes," C. J. Snyder, Jr., Koppers Co., Inc. The properties of heat resistant styrenes are such as to have led to their use in television receiver masks, windshield wipers, fluorescent lighting fixtures, camera cases, and other components. There is an increasing trend toward the use of these materials in new products and applications that take advantage of their improved properties.

THURSDAY, JANUARY 28

"Automatic Injection Molding," E. P. Moslo Machinery Co. Fully automatic injection molding machines require an electrical control system whose components are of highest quality; a suitable hydraulic system with an oil reservoir at least three times the pump capacity; and proper mechanical design. This mechanical design should include interchangeable components; adequate clamp mechanism; close tolerances on all parts; an oversized preplasticizing chamber; and a compensating feed mechanism. Mold and nozzle design considerations are other important factors in automatic molding.

"Accessory Equipment Required to Injection Mold Quality Pieces," W. E. Rahm, Boonton Molding Co. Factors essential for quality control in molding include drying of material; mold circulation for temperature control; suitable instrumentation of the molding machine; proper size reduction of scrap parts for reruns; and screening of reground material. Desirable, although optional, factors include weigh feeding; hopper loaders; degating by mechanical or other means; annealing and cleaning of molded parts; X-ray inspection of moldings; and push-on hose fittings for mold cooling fluid circulation systems.

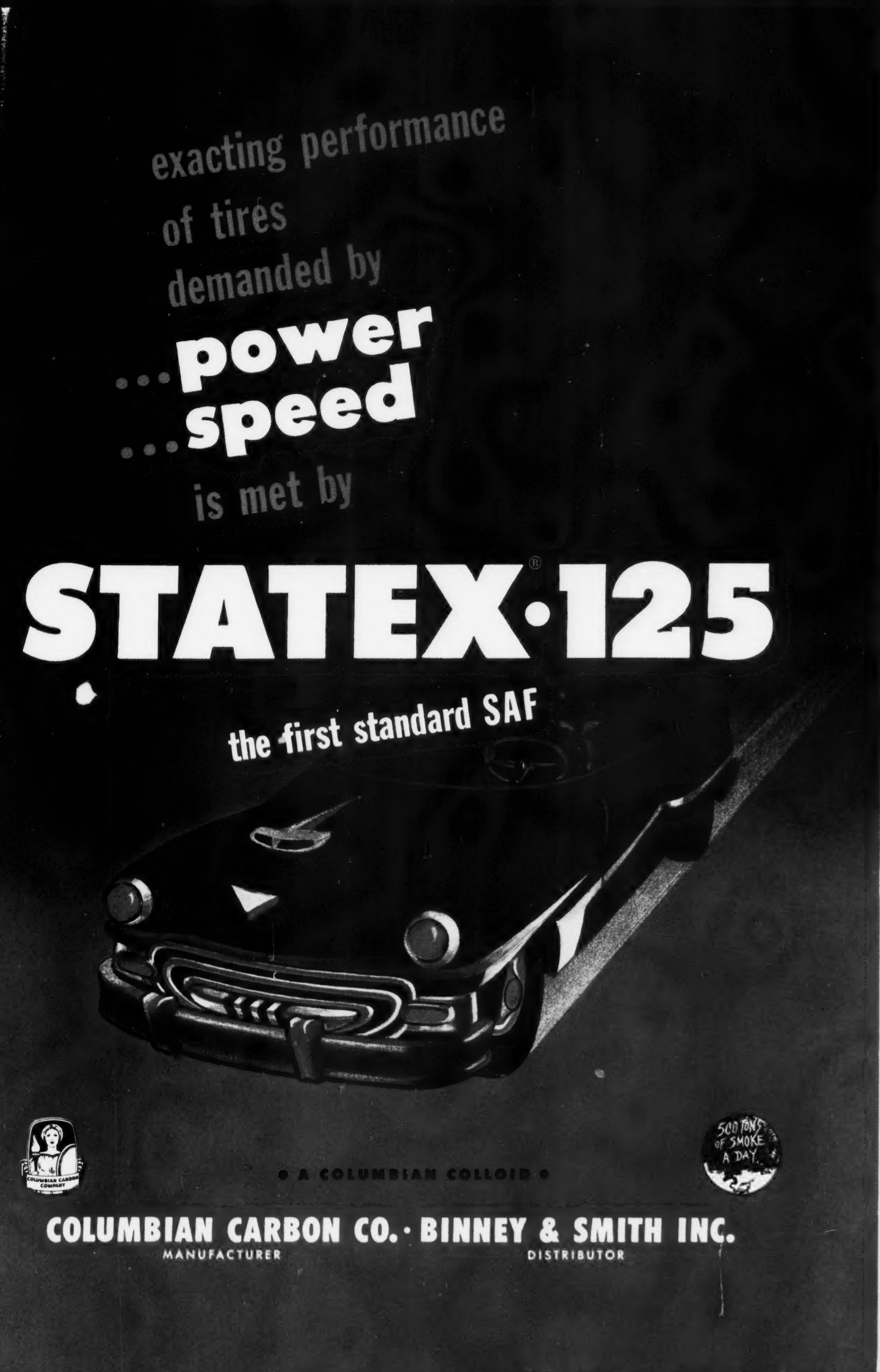
"Extrusion of Film and Sheeting," G. P. Kovach, Foster Grant Co. Factors influencing rigid sheet extrusion include stock preparation; screw design and heating method; die design; and take-off methods. The methods and problems involved in the extrusion of polyethylene and plasticized vinyl were described in detail, together with a comparison of the flat and blow extrusion methods for vinyl film.

An education forum was held at which the following talks were given: **"Industrial Interests in Education of Plastics Engineers,"** R. C. Bartlett, Natvar Corp.; **"Present Status of Education in the Field of High Polymers,"** C. C. Winding, Cornell University; **"Future Growth of the Plastics Industry Both in Size and Technical Quality,"** H. A. Gadd, Canadian General Electric Co., Ltd.; and **"A College View of a Plastics Engineering Education,"** J. H. Lampe, North Carolina State College. Mr. Bartlett presented results of a survey which showed the plastics industry to favor the SPE program of education for plastics

r sys-
three
r me-
design
nents;
toler-
eplas-
feed
con-
ors in

ed to
W. E.
s es-
g in-
lation
nstru-
roper
runs;
De-
clude
ating
ealing
y in-
hose
ation

ing,"
actors
clude
heat-
meth-
olved
plas-
, to-
and
n.
which
dus-
Plas-
atvar
on in
C. C.
ture
Both
I. A.
Ltd.;
En-
mpe,
Bart-
which
the
stics


exacting performance
of tires
demanded by
...power
...speed
is met by
STATEX®·125
the first standard SAF
COLUMBIAN CARBON COMPANY
500 TONS OF SMOKE A DAY
• A COLUMBIAN COLLOID •
COLUMBIAN CARBON CO. · BINNEY & SMITH INC.
MANUFACTURER
DISTRIBUTOR

engineers. Dr. Winding reported on a survey which showed that institutions oppose the introduction of required specialized courses on the undergraduate level. Mr. Gadd reviewed the growth of the plastics industry and emphasized the need of adequate training of engineers in universities. Dr. Lampe noted that while the need of college trained people in plastics engineering is evident, educators think that emphasis should be placed on fundamentals and basic engineering at the undergraduate level, with specialized courses for graduate work.

"Liquid Polymers Combined with Epoxy Resins," J. S. Jorczak, Thiokol Chemical Corp., and J. A. Belisle, now with Grumman Aircraft Corp. Liquid polysulfide polymers as modifiers for epoxies provide permanent flexibility, low strain, and low viscosity in embedment and casting applications; high impact and low shrinkage in glass fiber laminates; and low strain, flexibility, and improved wetting properties in adhesives.

"Arcing Tests on Plastics," T. J. Martin and R. L. Hauter, both of Boeing Airplane Co. A new technique has been developed for testing insulating materials in the presence of sustained electrical arcing simulating a circuit failure. Results of tests on a wide range of materials were given, and it was indicated that phenolics must not be used in places where such arcing is possible.

FRIDAY, JANUARY 29

"Vinyl Paste Resins—Today and Tomorrow," W. D. Todd, B. F. Goodrich Chemical Co. Vinyl plastisols and organosols ranging in consistency from putty-like pastes to thin fluids can be molded, spread, dip coated, printed, and sprayed and then converted into tough solids by simple heat treatment. The compounding, processing, and applications of these materials were described.

"Crazing of Polystyrene," E. E. Ziegler, Dow. A new, simple test has been developed which permits determination of the effects of variables on polystyrene crazing. The influence of time, temperature, reagents, and type of exposure on crazing was discussed.

"Theory on the Changes in Physical Characteristics of Plastics Caused by Radiation," J. W. Ryan, General Electric Co. Radiation studies of plastics by means of alpha, beta, and gamma rays provide valuable information on stability, particularly as regards high-temperature service. Test data indicate the existence of a "functionality series" wherein a higher functional group tends to transmit energy received from the interaction with a photon to a lesser transmitting group where it decomposes selectively.

"Effect of Multiaxial Stretching on Crazing and Strength Properties of Newly Developed Transparent Plastics," Irvin Wolock, NBS. Various plastic glazing materials were tested to determine the effect of multiaxial stretching. Results show that abrasion resistance is lowered; tensile strength improves slightly; elongation is greatly improved; and modulus of elasticity is essentially unchanged by this stretching. Tests also show that the threshold stress for stress-solvent crazing is raised by stretching. Annealing also improves resistance to stress-solvent crazing.

"The Application of Adiabatic Techniques to Polyethylene Extrusion," J. M. McKelvey and E. C. Bernhardt, both of E. I. du Pont de Nemours & Co., Inc. Studies of adiabatic extrusion (where heat generated by mechanical working is not removed, and no transferred heat is added to the plastic) indicate an interrelation of the factors of extrusion rate, temperature, pressure, screw speed, power consumption, and screw design. Proper screw-design selection can be used to obtain optimum performance in polyethylene extrusion.

"The Mechanical Properties of Polyethylene," R. H. Carey, Bakelite. Several test methods for the mechanical properties of polyethylene are discussed, and it is shown that selection of the test method depends primarily on the application involved. Accumulated data are still insufficient to predict long-time stress behavior at elevated temperatures, and use of these data involves hazards.

The SPE professional activities committee, under the chairmanship of Mr. Bracken, reported on its work during the past year and on plans for 1954. L. M. Debing, du Pont, stated that a series of nine articles on quality control is planned for publication in the *SPE Journal*, and that the first article will appear in about three months. B. Kellam, Hydro-Electric Power Commission of Ontario, revealed that studies of dermatitis in the plastics industry indicate the hazards to be minor and encountered only in production and fabrication. A report from Mr. Hoffman stated that work is under way to set up a standard test to determine the effect of moisture content in phenolics on electrical properties. Work is in progress on a compilation of visual defects in plastic products, according to a report from W. M. Schrag, Gering Products, Inc. Mr. Bracken summed up the work of the committee and asked members to submit problems for future study.

"Cutting Costs with Quality Control," Dorian Shainin, Rath & Strong, Inc. Modern quality control can lower manufacturing costs by improving precision and accuracy. Techniques are available to reduce the costs of attribute rejects, variable rejects, and too much or too little inspection of parts. These techniques include the use of control charts, analysis of variation, and statistical sampling plans.

Local Sections Reports

Prehardened Mold Steel Discussed

A talk on "Prehardened Mold Steels for the Plastics Industry" by B. L. Johnson, Jr., chief research metallurgist of Latrobe Steel Co., featured the February 17 dinner-meeting of the New York Section, SPE. Some 85 members and guests attended the meeting, which was held at the Gotham Hotel, New York, N. Y., and also included a showing of the IBM sound-color film on electronic calculators, "Piercing the Unknown." The film was introduced by J. F. Collins, of IBM, who also answered questions from the floor.

Mr. Johnson began his talk with a brief review of the different mold steels available to the plastics industry. These steels are of three types: (1) low carbon, low alloy hobbing steels; (2) alloy carburizing, oil hardening, and air hardening steels for molds which are heat treated after machining; and (3) oil hardening and precipitation hardening steels which are hardened prior to machining of mold cavities. This third class, the prehardened steels, are represented by AISI 4130 and 6145 for the oil hardening type and by nickel-aluminum steel for the precipitation hardening type.

Using slides to illustrate his talk, the speaker discussed the properties and the applications of the three classes of mold steels. It was pointed out that the precipitation hardening nickel-aluminum steel shows maximum hardness throughout, with no skin-core effect; can be polished readily to a very high luster because of its micro-structure; gives weldings which can be machined and polished like the rest of the mold; and lends itself to nitriding.

Prehardened steels have found their most extensive application in the plastics industry in injection molds, Mr. Johnson said. Their application in compression and transfer molds has been limited so far, but should increase as more experience is gained in operation. It is apparent that the potential usefulness of prehardened mold steels has only begun to be realized, the speaker concluded.

Table favors were distributed through the courtesy of Ferro Corp. and Leaf Plastics, Inc., and the meeting closed with a drawing for door prizes contributed by R. C. Molding, Inc., and Star Plastics Co.

Chicago Elections

The Chicago Section, SPE, announced the election of M. A. Self, Logo, Inc., as president, R. K. Gossett, Gossett & Hill, as vice president, and R. Hanna, Hercules Powder Co., as secretary-treasurer.

These results were made public at the January 20 joint dinner-meeting of the group with the Midwest Chapter, SPI, which was attended by some 130 persons. Speaker for the evening was Austin Kiplinger, author and radio and television commentator, who gave his views on "What Is Ahead."

Plastics in Metal Fabrication

SOME of the more sweeping claims made for plastics in the field of metal fabrication should be "debunked," according to F. L. Bogart, Marblette Corp., speaking at the annual meeting of the Steel Plate Fabricators Association late in January in Chicago, Ill. Mr. Bogart explained that plastic dies in some applications cost more than metal dies, but, when properly used, phenolic and other plastic tools can accomplish production improvements and economies.

The correct use of plastic tools must be considered in relation to the three major types of production runs: limited runs for making prototypes; short runs of up to 20,000 parts; and extended runs over 20,000 parts. Plastics are ideal for the first type, the speaker said, offering savings of up to 90% in time and better than 50% in costs. With limited runs more durability is required, but phenolics have been used effectively. In extended runs service costs become important factors, and currently available plastics can be used only in limited applications.

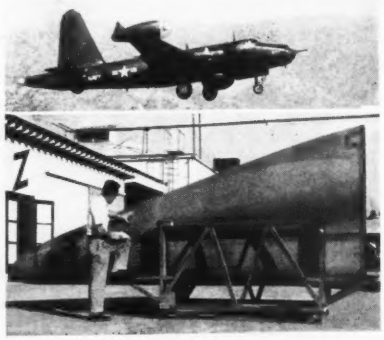
Some 70% of present tooling is of steel because of the limitations of current plastics in shearing and piecing operations, Mr. Bogart noted. Plastics have a much more prominent place in secondary operations, however, and are widely used for locating and nest blocks. Development work on new and better forms of plastics is constantly going on, and plastic materials can be expected to find eventually a greater use in metal fabrication.

Other speakers at the meeting included Charles Kramer, Karpart Corp., who demonstrated the use of rigid vinyl; Thomas Grimes, United States Rubber Co., who discussed Royalite copolymer sheeting; and Jean Malone, B. F. Goodrich Chemical Co., who described a new composition of textured vinyl laminated to thin steel sheets for use in machine housings. There was also a demonstration by American Agile Corp. on the use of stressed polyethylene liners for steel vessels.

SPI Reinforced Plastics Conference Highly Successful

THE great interest being shown in reinforced plastics was reflected by the registration total of 1,260 rung up at the ninth annual Technical and Management Conference of the Reinforced Plastics Division, Society of the Plastics Industry, Inc., held at the Edgewater Beach Hotel, Chicago, Ill., February 3-5. The three-day meeting included daily morning and luncheon sessions; an evening session on February 3; a banquet on February 4; afternoon personal contact periods; and a forum on the afternoon of February 4 where questions were answered by a panel comprised of speakers at the Conference.

Concurrent with the meeting was an exhibit of reinforced plastics products, covering a wide range of applications. Of special note was a 17-foot long stinger tail section molded by Zenith Plastics Co. for the Neptune P2V patrol bomber. This section was said to cost about one-fifth the price of a conventional metal tail and to be the first large fuselage structure made of reinforced plastics manufactured on a mass production basis as an integral part of the aircraft design.



Seventeen-Foot Stinger Tail Section of Reinforced Plastics Made by Zenith Plastic for the U. S. Navy's Neptune Patrol Bomber

WEDNESDAY, FEBRUARY 3

J. B. Alfers, Navy Bureau of Ships, presided over the morning session which was a government agency forum at which the following 10 papers were presented: **"Development of Navy Plastics Ammunition Containers,"** J. W. Case, Navy Bureau of Ordnance; **"Long-Range Materials Conservation for Defense,"** F. P. Huddle, Office of the Assistant Secretary of Defense; **"Chlorosilane Finishes for Glass Fabrics,"** H. A. Perry, Jr., P. W. Erickson, I. Silver, and H. E. Mathews, Jr., all of the Naval Ordnance Laboratory; **"Variations in the Preparation of Test Panels,"** Perry and Silver, D. Peugh, and F. R. Barnet, all of the Naval Ordnance Laboratory; **"Low-Temperature Processing of Alkyd Diisocyanate Foams,"** H. R. Moore, Naval Air Development Center; **"Recent Developments at the Material Laboratory, New York Naval Shipyard: I—**The Pullout Strength of Fasteners in Polyester Glass Laminates; **II—**Compressibility of Glass Reinforcing Materials," N. Fried, A. Stenstrom, and R. R. Winans, all of N. Y. Naval Shipyard; **"Bureau of Ships' Progress Report on Structural Plastics,"** Mr. Alfers and W. R. Graner, Navy Bureau of Ships; **"The Role of Foamed Plastics in Aircraft,"** J. M. Stevens, Navy Bureau of Aeronautics; **"The Application of Sandwich-Type Construction to Reinforced Plastic Marine Craft,"** K. T. Marshall, Fort Eustis; and **"Materials and Process Requirements from Aircraft Plastics,"** D. Rosato, Wright Air Development Center.

The luncheon session, at which A. L. Smith, Rohm & Haas Co., presided, featured the presentation of reports from the various standards committees, as follows: electrical flat sheet—H. R. Sheppard, Westinghouse Electric Corp.; flat sheet structural—B. B. Curl, Flexfirm Products, Inc.; corrugated panel—J. S. Berkson, Alsynite Co. of America; housings and appliances—E. F. Bushman, General American Transportation Corp.; boats—I. M. Scott, Winner Mfg. Co.; chemical resistant applications, R. J. Brinkema, R. J. Brinkema Co.; containers—A. W. Levenhagen, Molded Fiberglass Tray Co.; pipe—G. A. Stein, A. O. Smith Corp.; rod stock—R. J. Francis, consultant; decorative laminates— L. S. Meyer, consultant; premix—L. Wittman, Cordo Molding Products, Inc.; preform—A. J. Wiltshire, Apex Electrical Mfg. Co.; and nomenclature—Mr. Curl.

The evening meeting consisted of five concurrent industry forums. Forum topics and their presiding officers, who also spoke briefly on the subjects, were as follows: **"Premix,"** Mr. Wittman; **"Parting Agents,"** J. S. Lunn, Lunn Laminates, Inc.; **"Avaliable Finishing Systems for Reinforced Plastics,"** B. W. Nelson, National Cash Register Co.: **"Tooling,"** J. C. Reib, Shaw Industries, Inc.; and **"New Developments in the Field of Resins,"** J. S. Finger, Corrulux Division of Libbey-Owens-Ford Glass Co. The session on tooling included a talk on **"Cast Aluminum Tooling for Large Reinforced Plastic Parts,"** by J. Cuming, M. A. Cuming Co.

The forum on resin developments featured a 19-man panel, as follows: E. W. Moffett, Pittsburgh Plate Glass Co.; J. Greenfield, U. S. Industrial Chemicals Co.; W. E. Wirsch, Rohm & Haas; W. J. Maker, Glidden Co.; R. C. Dauphine, Hooker Electrochemical Co.; H. M. Day, American Cyanamid Co.; M. Kin and K. R. Hoffman, both of Dow-Corning Corp.; P. V. Steenstrup, General Electric Co.; S. E. Susman, Narmco, Inc.; D. G. Patterson, Reichhold Chemicals, Inc.; R. G. Nelb, Naugatuck Chemical Division of United States Rubber Co.; R. B. Seymour, Atlas Mineral Products Co.; H. A. Hoppens, Barrett Division of Allied Chemical & Dye Corp.; J. E. Carey, Shell Chemical Corp.; J. R. Charlton and M. Wismer, both of Ciba Co., Inc.; S. A. Moore, Interchemical Corp.; and R. J. Savage, Celanese Corp. of America.

THURSDAY, FEBRUARY 4

The morning session was a panel on processing, presided over by W. B. Wilkins, consultant. Eleven papers were presented, as follows: **"Contact Molding,"** C. A. McGill, Lone Star Boat Mfg. Co.; **"Bag Molding,"** Lunn and Scott; **"Vacuum-Type Injection Molding,"** G. Lubin, Bassons Industries Corp.; **"Pressure-Type Injection Molding,"** E. Y. Wolford, Koppers Co., Inc.; **"Preform and Mat Molding,"** S. Fingerhut, Zenith Plastics, and S. S. Oleesky, Micronics, Inc.; **"Premix Compound Compression Molding,"** R. B. White, Glastic Corp.; **"Premix Compounding Transfer Molding,"** V. G. Reiling, Modern Industrial Plastics, Inc.; **"Prepreg Molding,"** Mr. Wittman; **"Continuous Laminating,"** Mr. Meyer; **"Continuous Extrusion,"** W. B. Goldsworthy, Industrial Plastics Corp.; and **"Potting,"** G. Firth, McCulloch Motors Corp.

R. S. Morrison, Molded Fiberglass Co., presided over the luncheon session, which featured a talk on **"The Corvette Plastic Body,"** by E. J. Remo, Chevrolet Division of General Motors Corp.

Highlighting the banquet was a talk, "Grist for the Grin Mill," by O. M. Brees. H. B. Freeman, American Cyanamid, acted as toastmaster at the banquet.

FRIDAY, FEBRUARY 5

R. Malamphy, Naugatuck Chemical, presided over the morning session at which the following five papers were given: **"To Conceal or Reveal—Special Fiber Treatments Can Produce Salable Effects,"** Mr. Bushman; **"Reinforced Plastic Tooling,"** F. Lyijynen, Briggs Mfg. Co.; **"Chemical Resistant Applications,"** S. W. Shepard, Chemical Construction Corp.; **"Quality Control in Aircraft Plastics,"** H. S. Kraus, North American Aviation, Inc.; and **"New Evaluation Techniques for the Effect of Glass Sizings on Glass Reinforced Plastics,"** G. W. Bainton, Jr., C. J. Guare, and K. N. Mathes, all of G. E.

Speaker at the luncheon meeting was Hiram McCann, *Modern Plastics,* on "The Pattern of Our Progress." Mr. Berkson presided over this session.

In addition to the open forum previously mentioned, the afternoon session saw the following six papers presented: **"Grinding Glass Fiber-Reinforced Plastics,"** R. T. Argy, Carborundum Co.; **"Parallel Glass Fiber Laminates and New Resin-Glass Bonding Techniques,"** J. D. Robinson, Englander Co., and Mr. Case; **"Silicone Release Agents for Organic Resins,"** C. C. Currie and W. C. May, both of Dow-Corning; **"Controlling Flow Properties with Fillers,"** J. R. Wilcox, Edgar Bros. Co.; **"A New Coupling Agent for Glass Fiber Roving Polyester Products,"** J. H. Plummer and C. F. Neumeyer, both of Glass Fibers, Inc.; and **"The Use of Tool Plastics for Cutting Costs in the Reinforced Plastics Industry,"** N. M. Hasting, Rezolin, Inc.

Price Reduction

GLACIAL methacrylic acid, as manufactured by Rohm & Haas Co., Philadelphia, Pa., has again been reduced in price. This reduction, amounting to 20¢ a pound, brings the carload price of the material down to 54.5¢ a pound for carload drum quantities (f.o.b. Bristol, Pa.), with higher prices for smaller amounts. Applications for the material include adhesives; textile sizes; and polymer latices for paints, textiles, paper, and leather.

No Hyatt Award This Year

AT THE request of the patron, Hercules Powder Co., no Hyatt Award will be made this year, according to an announcement from William T. Cruse, secretary of the award committee and executive secretary of The Society of the Plastics

(Continued on page 794)

Scientific and Technical Activities

Akron Group and Local SPE Section Symposium on Resin-Rubber Blends—III*

Blends of Polyvinyl Chloride with Rubbers

W. J. Smith[1]

POLYVINYL chloride resins may be compounded and fluxed to yield end-products ranging from hard, rigid, brittle items to soft, flexible, tough ones. The great bulk of applications for these resins to date has required products with some degree of flexibility and toughness. While rubbers can be used in small amounts in rigid products, this discussion will deal primarily with the modification of polyvinyl chloride into more flexible items partially or wholly through the addition of elastomers.

The acrylonitrile-butadiene copolymers, or nitrile rubbers, are by far the most commonly used elastomers for plasticizing or softening of polyvinyl chloride polymers and copolymers. These nitrile rubbers can be prepared with varying amounts of acrylonitrile, with different Mooney viscosities, with different modifiers, and in varying physical form. All these variations can have a large bearing on the ease of processing of the resin-rubber mixture and on the resultant physical properties.

Polyvinyl chloride may be plasticized exclusively with the nitrile rubber, or, as is more common, with a mixture of the nitrile rubber and liquid plasticizers. In general, nitrile rubbers with medium acrylonitrile content, in the range of 30 to 37%, are the most useful for plasticization of the vinyl chloride resins. Rubbers with both higher and lower acrylonitrile contents, however, are compatible with polyvinyl chloride resins and are used where they can contribute to specific end-properties.

Properties of Blends

Nitrile rubber plasticized vinyl chloride resins are characterized by excellent retention of flexibility and impact resistance after prolonged or repeated contact with oils, greases, and aliphatic hydrocarbons in general, or prolonged exposures to elevated temperatures. This quality of being able to retain flexibility and impact strength after exposure to conditions which cause normally plasticized vinyl chloride resins to become stiff and brittle makes these blends very useful in many troublesome applications.

Among the less desirable characteristics of vinyl chloride, resin compositions plasticized with nitrile rubbers have been the relatively poor resistance to light aging, the low plasticizing efficiency of the nitrile rubber, as compared with the efficiency of most liquid plasticizers, and the processing problems which also have been encountered.

Proper stabilization of vinyl resin and the rubber will improve aging and reduce processing problems. Use of a liquid plasticizer chosen for its effect on the rubber rather than the resin will aid processing of the mixture and will give added smoothness of surface to calendered or extruded products.

Tensile strength of nitrile rubber and vinyl chloride resin blends is usually lower than for vinyl chloride resin plasticized to equivalent hardness with liquid plasticizers such as DOP. In very flexible calendered sheets, or extruded sections, blocking becomes more of a problem with the nitrile rubber plasticized compositions than with the liquid plasticizer mixes. Both of these properties can be improved, and greater resiliency and abrasion resistance can be obtained by vulcanizing the vinyl resin-nitrile rubber blend. Mercaptobenzothiazole and benzothiazyl disulfide are satisfactory accelerators of vulcanization. Such cured stocks are no longer thermoplastic to the point of reworking, but they can be post-formed into useful articles after heating. Blocking of mixtures containing high percentages of nitrile rubber may also be reduced by use of lubricants such as Acrawax C or paraffin wax.

The effect of some variations in preparation of the nitrile rubbers on physical properties of the polyvinyl chloride-nitrile rubber blends may be summarized in a very general way as follows:

1. As the acrylonitrile content is increased, grease and oil resistance is improved; tensile strength increases; processability is easier; product surface is smoother; low temperature impact is poorer; resilience decreases; and blocking is reduced.
2. As the Mooney viscosity is increased, processability is poorer; product surface has a rougher appearance; low-temperature impact is better; and blocking is again reduced.

In addition to the nitrile rubbers, polyvinyl chloride resin compositions have also been modified with other rubbers such as GR-S, polyisobutylene, and substituted acrylonitrile-butadiene copolymers. Many interesting variations in toughness, hardness, impact resistance, abrasion and chemical resistance can be obtained by modification of polyvinyl chloride polymers and copolymers with these individual rubbers or with combinations thereof.

Mixing and Processing

Polyvinyl chloride and rubber mixtures are generally prepared by one of the following methods:

1. In one method, a preblend of the vinyl chloride resin, stabilizer, lubricant, fillers, liquid plasticizers, and color is made and fluxed on a hot mill (270-350° F.) or in a Banbury mixer (280-340° F.). The rubber is then incorporated with this fluxed resin blend.
2. In a second method, the rubber is premasticated on a cold or hot mill, or in a Banbury mixer before being added to the vinyl resin blend as above.
3. In a third method, the rubber is premasticated on a cold mill, and the vinyl resin and other compounding ingredients are added to the rubber as a filler, while milling. The batch is later fluxed on a hot mill or in a Banbury.
4. In another method, the rubber is premasticated in the Banbury mixer, and the vinyl resin preblend or individual ingredients are added thereto. The whole batch is fluxed at temperatures ranging from 270-350° F.
5. In still another method, a powdered, or fine crumb, form of the rubber is preblended with the vinyl chloride resin and other compounding ingredients in a ribbon blender or other-type premixer. The batch is subsequently fluxed on a hot mill or in a Banbury mixer.
6. In the final method, a homogeneous mixture of the rubber and resin is prepared by cocoagulation or coprecipitation of blended latices or slurries of each. Other compounding ingredients are added to the resultant blend on either a hot or cold mill, or in a Banbury mixer.

The method of preparation to be used depends on the rubber content of the final stock, the permissible mixing time, the ease of processing required, and the desired smoothness of surface of the finished product.

Where the rubber is only a minor portion of the total mix, the compound is usually mixed in the same fashion as an ordinary vinyl chloride resin stock, but premastication of the rubber will result in easier processing and a smoother surfaced finished item.

Where the rubber accounts for a substantial part of the total mix, good processing and a smooth surfaced finished product are obtained by intimate mixing of the vinyl chloride resin and the rubber prior to fluxing of the blend. This is most satisfactorily accomplished by the cocoagulation or coprecipitation method. Nerviness of nitrile rubbers, which is particularly noticeable in mill mixing, is thus largely eliminated.

Another method of improving processing and surface appearance of vinyl chloride resin and nitrile rubber products is to break down the rubber on a cold mill in conjunction with addition of approximately an equal amount of calcined clay. Still an-

* Concluded from our Feb., 1954, issue.

[1] Firestone Tire & Rubber Co., Pottstown, Pa.

other method is the hot milling or Banburying of the rubber to the point where its Mooney viscosity has reached the second minimum. This latter result can also be duplicated by special polymerization techniques through which the nitrile rubber is partially cross-linked with divinyl benzene.

It is always necessary to flux the vinyl resin, at some point in the process, to obtain its maximum contribution to the properties of the mixture. This fluxing is done by raising the mix to a temperature of from 270 to 360° F., depending upon the type of vinyl chloride resin and the particular compound used.

Calendering of polyvinyl chloride-rubber blends is carried out in essentially the same way as straight polyvinyl chloride-liquid plasticizer compositions. The success of the calendering operation and the appearance of the finished sheet or film depend very much on the processability of the rubber, particularly as the percentage of rubber in the mixture is increased. Choice of Mooney value, acrylonitrile content, and physical form should be such as to give minimum nerve and graininess under the conditions of processing required to obtain the desired physical properties.

Strength properties of vinyl chloride and nitrile rubber blends are primarily dependent on the degree of fusion of the vinyl chloride resin. Higher milling and calendering temperatures (up to 360° F.) will result in better tensile strength provided both the vinyl chloride resin and the nitrile rubber are adequately heat stabilized. AgeRite Stalite,[2] Deenax,[3] and Ionol[4] are useful stabilizers for retarding oxidation of the rubber during processing; while a variety of lead compounds, the barium, cadmium laurate-epoxy resin combinations, and some tin compounds will prevent heat decomposition of the vinyl.

Processors of films of 0.010-inch and thinner must take special precautions in calendering vinyl chloride nitrile rubber blends. At such small roll openings, and at the processing speeds usually used for thin films, the heat build-up in the calender banks is much greater in stocks with high rubber content than with liquid plasticized compositions of similar flexibility. Double, or even triple, the normal quantities of the most effective vinyl chloride resin heat stabilizers may be required. Added amounts of lubricant may also be required to obtain smooth and even release from the calender rolls, as well as to avoid blocking in the roll of finished film after storage. These problems are less troublesome with heavier-gage films and sheetings, and as the rubber content of the stock decreases.

Extruders of polyvinyl chloride resin and rubber blends have a choice of feeding a fluxed resin compound or a compounded rubber to the extruder. The type of premixing equipment available usually determines this choice, although it is desirable to provide as little heat history as possible for both resin and rubber prior to the extrusion. In either case the extrusion temperatures must be such as to flux completely the vinyl chloride resin if optimum physical properties are desired. Temperatures of from 300 to 360° F. are usually adequate.

Polyvinyl chloride resin and nitrile rubber blends have also been made into very thin cast films which can be cured during the drying operation. Such films are very interesting as packaging materials, having excellent grease and oil resistance, good clarity, high tear and tensile strength, and, with suitable compounding, good resistance to moisture vapor transmission. Complete solubility of the rubber in the resin solvents is necessary for best results from such mixtures, as well as some of the other characteristics needed for a nitrile rubber that will calender well with vinyl chloride resin.

Polyvinyl chloride resin and nitrile rubber blends are used in the following applications: (1) jacket insulation on coaxial cable over polyethylene primary insulation; (2) as primary insulation on low-voltage appliance wires; (3) upholstery sheeting; (4) extruded shoe welting and shoe uppers; (5) thermoplastic tubing for beverages, gasoline, oil, solvents, and industrial chemicals; (6) hospital sheeting and industrial aprons; (7) packaging films; (8) camera case coverings, motorcycle seat covers, and binocular containers; (9) cured compounds for printing roll covers, gaskets, valve disks, football and basketball covers.

Questions and Answers

Q. Does the use of nitrile rubber always reduce the tensile strength of PVC compositions?

A. We have not found, in any of our work, that the addition of nitrile rubber will result in an increase in tensile strength over what is obtainable by plasticizing the vinyl chloride resin with liquid plasticizers to equivalent flexibility. It is possible, however, to maintain or only slightly reduce tensile strength by making certain the mixture is completely fluxed at a high enough temperature to provide optimum fusion of the vinyl. On this basis up to 40 parts of nitrile rubber can be added to the vinyl chloride composition, with proper adjustment of liquid plasticizer for final flexibility, without an appreciable effect on the tensile strength of the mixture.

Q. Is it possible to obtain knotty tear with polyvinyl chloride compounds?

A. If by knotty tear is meant the tendency for a tear to show a character of intermittent resistance and non-resistance, I would say that it is difficult to obtain any other kind of a tear with PVC and nitrile rubber blends. Only the most intimate and most thorough mixing of the vinyl chloride and nitrile rubber will give a smooth tear. Incomplete breakdown of the rubber before being added to the vinyl or addition of the rubber after the vinyl is fluxed will generally result in a marked knotty tear. One way of obtaining a smooth tear is to cocoagulate and coprecipitate the rubber latices. Proper subsequent processing will usually produce a sheet with a smooth tear. A knotty tear can be obtained with a non-rubber polyvinyl chloride film or sheeting by using high-filler loadings or by the use of moderate to high amounts of solid plasticizers.

Q. How does the cost of nitrile rubber compare with the cost of suitable liquid plasticizers?

A. Cost is only one of the reasons why nitrile rubbers have not had more widespread application as plasticizers for vinyl chloride resin. The most compatible of the nitrile rubbers, with the higher acrylonitrile contents, are about 58¢/lb.; while the lower acrylonitrile content rubbers are in the neighborhood of 50¢/lb. This compares with DOP currently selling at 35¢/lb. However, to achieve the resistance to oils and aliphatic hydrocarbons and the retention of flexibility upon prolonged heat exposure required for some vinyl chloride applications it is necessary to use either polymeric plasticizers or nitrile rubbers. The polymeric plasticizers which are most effective cost from 68-85¢/lb. and some are only slightly more efficient in producing flexibility than the nitrile rubber. Processing difficulties and light stability rather than cost are the major factors dictating use of liquid polymeric plasticizers in preference to the nitrile rubbers.

Q. What heat stabilizers are suggested for blends of nitrile rubber and PVC, both lead type and lead-free type?

A. Lead stabilizers, such as Dyphos[5] and Dythal,[5] lead silicate, and lead stearate can be satisfactorily used. Non-lead stabilization which is suitable includes the cadmium-barium mixtures, such as Argus Chemical's Mark XI,[6] Ferro 1820,[7] and Harshaw's 2V4 and IV3[8] coupled with suitable chelating agents such as Argus Chemical's Mark XX, Ferro 903, Advance Chemical's CH-20,[9] or Harshaw's 7V1. Addition of stabilizing plasticizers like Paraplex G-60[10] or G-62 also aids heat stability of these blends and is particularly useful with the cadmium-barium combinations. A straight cadmium stabilizer such as Firestone's ST-100[1] will also do a good job of heat stabilization for such blends. The tin stabilizers which have appeared to be most useful include Metal & Thermit's RS-20[11] and their Thermolite 99.[11] The rubber should also be stabilized with suitable antioxidants. Deenax, Wingstay S,[12] Ionol, and AgeRite Stalite are commonly used for this purpose.

Q. What light (U.V.) stabilizers are used?

A. We do not know of any way to achieve light stability, as measured by color fastness, in vinyl chloride nitrile rubber blends which is equivalent to the light stability of vinyl chloride plasticized with liquid plasticizers such as DOP. Lead stabilizers such as Normasal and Dyphos will aid light stability of the vinyl portion of the mix. Generally the non-lead heat stabilizers such as the barium-cadmium, straight cadmium, or tin compounds, if used in quantities slightly greater than minimum requirements for heat stabilization, will add to light stability. Some further improvement in light stability can be obtained by use of tin stabilizers, such as dibutyl tin di laurate, or Vanstay L.[2] Both heat and light aging of the rubber in the mixture are aided by addition of antioxidants such as AgeRite Stalite, Deenax, Ionol, and Wingstay S. In general, substituted high-boiling phenols are useful in this regard.

Q. How do such blends of nitrile rubber and PVC compare in heat stability characteristics as compared to 100% polyvinyl chloride during processing?

A. In comparing the heat stability characteristics of one vinyl chloride resin composition with another we usually note both the stiffening effect of the heat exposure and the color change. In oven exposures, vinyl chloride-nitrile rubber blends show more color change than vinyl chloride plasticized with straight liquid plasticizers such as DOP, but they do not stiffen as much. This color change is accentuated during processing because of the added frictional heat build-up in the nitrile rubber compositions.

---

[2] R. T. Vanderbilt Co., 230 Park Ave., New York 17, N. Y.
[3] Enjay Co., Inc., 15 W. 51st St., New York 19.
[4] Shell Chemical Corp., 50 W. 50th St., New York 20.
[5] National Lead Co., 111 Broadway, New York 6.
[6] Argus Chemical Laboratory, 633 Court St., Brooklyn 31, N. Y.
[7] Ferro Chemical Corp., P. O. Box 349, Bedford, O.
[8] Harshaw Chemical Co., 1945 E. 97th St., Cleveland 6, O.
[9] Advance Solvents & Chemical Corp., 245 Fifth Ave., New York 16.
[10] Rohm & Haas Co., Washington Sq., Philadelphia 5, Pa.
[11] Metal & Thermit Corp., 100 E. 42nd St., New York 17.
[12] Goodyear Tire & Rubber Co., Akron, O.

Resin-Rubber Rigid Blends—A Summary

Anthony J. Urbanic[1]

WHEN small portions of a specified rubber are added to a resin, we obtain certain advantages as well as other changes that may be regarded as disadvantages. The usual and, of course, important advantage of adding a rubber to a resin, as you all know, now is an improvement in toughness—the impact strength is raised both at room temperature and below. The rubber increases the flexibility and elongation of the resin so that a sudden force on the plastic is more easily dissipated without fracture. Most often 20 or more parts of rubber must be added to a brittle resin to get the desired degree of useful toughness, and the more rubber that is added the greater is the improvement. Other advantages which are minor, but important at times, are the improvement in the hot tear strength and the lowering of the processing temperature. The former is important in both extrusion and calendering. Much difficulty is experienced with synchronizing take-off equipment with an extruder or calender with a poor hot tear strength material. The lowering of the processing temperature may be important also if the resin tends to decompose or to depolymerize. Otherwise some porosity in the finished product may be had.

Some Disadvantages from Rubber Addition

On the other hand, certain disadvantages result from the addition of the rubber portion. It is a give-and-take proposition. You just don't get anything for nothing. The heat distortion, hardness, and tensile strength are usually lowered; the amount increases with an increase of rubber content. Likewise, the processing conditions are altered as the resulting blend has usually poorer flow properties than the resin itself. For instance, an injection pressure of 18,000 psi. is needed for a rubber modified styrene blend on the market today; whereas 12,000 psi. would be satisfactory for the resin itself. These poorer flow properties usually lead to longer injection cycles or to slower extrusion speeds. The weathering properties of the blend are also usually inferior to that of the resin, and great care should be exercised in testing this property, especially the correlation of crazing and impact strength with time of weathering. This especially so if an outdoor end-use for the blend is contemplated. The staining brought about by the antioxidant present in the blend should also be checked. It may be said that an antioxidant which appears adequate for the rubber itself may not be satisfactory for the blend. This is because higher processing temperatures are required for the latter.

Shrinkage of resin-rubber blends may also be different from that of the resin itself, e.g., plain phenolic has a shrinkage of 0.008-inch/inch; whereas rubber-phenolic blend has a shrinkage of 0.010-inch/inch. Thus molds designed for the former, especially if close dimensional tolerances are wanted, cannot be used. Of course the solvent resistance of a resin is also altered by incorporation of a rubber. Some of the drawbacks of resin-rubber blends mentioned above have been corrected at least for certain blends. For instance, by replacing the usual commercial nitrile rubber with a high Mooney, very tight gel type in a styrene-acrylonitrile blend, the flow properties can be improved. Instead of a rough sheet off the calender, a smooth one is obtained by the modification.

What do we know about the rubber portion that forms a satisfactory resin-rubber rigid blend—will any rubber do, or is the composition important? Yes; the composition is important. We know that a certain amount of compatibility must exist between the two phases to get a satisfactory product. For instance GR-S has not been successfully combined with a standard-type phenolic because of lack of compatibility. Therefore nitrile rubbers are used with these standard phenolics because they are more compatible. On the other hand, a rubber that is too compatible may also be undesirable because of the marked effect on the heat distortion.

It may be honestly said that the art of resin-rubber blends is advancing more rapidly than the theory. For instance, even the necessity of the rubber portion in a blend has been questioned. Some results that have been reported lately seem to indicate that the toughness of a resin may also be improved by the addition of another resin. For instance, polyamide and polyvinyl acetate resins have been successfully mixed with epoxy resins to decrease the brittleness of the latter; so it is reported. Also a recent patent tells of the improvement of low-temperature impact strength of polyvinyl chloride with the addition of a styrene vinyl cyanide copolymer. It is the author's opinion, however, that only a small improvement in toughness results on adding a resin, as compared to the marked improvement in adding a rubber to a resin.

New Rubber-Resin Blends

The author was asked to make a few comments on other resin-rubber blends not mentioned so far, but which appear to have promising potential importance, or which have been reported.

1. EPON[2]-THIOKOL[3] SYSTEMS. All of us know the excellent adhesive property of Epons for adhering either polyester laminates to themselves, metal to metal, or other rigid materials to themselves. However, these Epons have been too brittle for adhering more flexible types of products. The toughness of the Epon bond has been improved, moreover, by incorporation of a Thiokol rubber, specifically Thiokol LP-2. Twenty-five parts of the latter toughen the adhesive considerably.

2. ISOBUTYLENE-STYRENE COPOLYMER MIXTURES. These systems are analogous to the butadiene-styrene systems discussed by Holt and Sell. The resins are high-styrene low-isobutylene copolymers, and the rubbers high-isobutylene low-styrene copolymers. Because these systems are saturated, they have better aging properties than their counterpart, the styrene-butadiene type.

3. NEOPRENE[4]-NEW STYRENE BLENDS. These blends give a tough, high heat distortion material which has a high impact resistance at as low as —20° C. These blends are not cured; which condition, of course, is an advantage in the elimination of curing cycles and in the disposition of cured scrap.

4. ETHYL CELLULOSE-RUBBER BLENDS. With natural rubber 10 parts of ethyl cellulose give a softer composition at the milling temperature and give an increased elongation at break.

With GR-S, 10 parts of ethyl cellulose give better dimensional stability and increased resistance to flex cut growth.

The most important methods of preparing resin-rubber rigid mixtures follow:

(1) The best method of mixing is in a Banbury, especially if the resin tends to flow readily at the mixing temperature, e.g., phenolics.

(2) Mill mixing is used, but has certain limitations including cost.

(3) Latex mixing followed by coagulation or spray drying insures that the two phases are intimately mixed.

(4) Ribbon blending of powder resin and powdered rubber is limited now because of the problem of preparing suitable powdered rubbers economically. Also, it would be desirable to get powdered rubbers that can be easily vulcanized.

(5) Ribbon blending of powdered resin and liquid rubber is also limited because of the difficulty of preparing liquid rubbers economically.

Other methods may be mentioned such as the incorporation of rubber during polymerization or the incorporation of chopped rubber with the resin in the extruder.

In the past the preparation of these blends has been done by the raw material suppliers. However, as this field of resin-rubber rigid blends will expand, and it definitely will, the blending will be taken over by many of the fabricators themselves, especially the larger ones who will formulate their own blends in the same manner that they now formulate their own recipes. It is at this time when we shall see the greatest expansion of rubber-resin blends—a time when we shall see the further merging of rubber and plastic industries, and a time when we shall see a further impact of this great combine on the automotive, appliance, machinery, and other industries.

Questions and Answers

Q. What applications do rubber-resin blends have in tire compounding?

A. Urbanic. They are utilized for obtaining superior adhesion between rubber and either rayon or nylon cord in tire building. The specific materials are a mixture of resorcinol-formaldehyde resin and a vinyl pyridine rubber usually applied to the cord from a latex mixture.

A. Sell. The thermoplastic nature of most of the resins (excluding the phenolics) limits their use in tire compounding. Even in the cured blends, where thermoplasticity is reduced, the poorer resilience of the resin-rubber compound, as compared to the rubber-black compound, rules out its use.

Q. What has been the reaction of any given industry, as for instance the appliance industry, to high-impact polystyrenes?

A. Generally speaking, the high-impact polystyrenes are satisfactory in the appliance industry, as for instance in making refrigerator parts, except for the following three complaints: (1) There is a certain amount of breakage, especially in transit, and the larger the part the greater the

[1] The General Tire & Rubber Co.

[2] Shell Chemical Corp., 50 W. 50th St., New York 20.

[3] Thiokol Chemical Corp., 784 N. Clinton Ave., Trenton 7, N. J.

[4] E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

breakage. (2) The heat distortion is too low in the Texas-Arizona areas. Heat distortion is 170° F. (3) Resistance to butter, oils, and insect sprays is poor.

Q. Is there any way to improve the heat stability of nitrile rubber?

A. Various antioxidants have been proposed, and we have tried many, but for very severe temperature conditions we have no answers. Materials like NBC[4] prevent a change in physical properties, but improve the ultra-violet stability just a little in terms of crazing.

Q. What about patents on these blends? Who has them; are there any restrictions on their use; any precautions which users should take to avoid infringement; is there any litigation going on or pending?

A. Stavely. There is a philosophy on patents that has been expressed in this manner, "Go ahead and do what you want to as it is the lawyer's job to get you out of trouble later."

Washington Spring Meeting of Committee D-11

A MEETING of Committee D-11 on Rubber and Rubber-Like Materials was held as part of the spring meeting of the American Society for Testing Materials at the Shoreham Hotel, Washington, D. C., February 5. A number of subcommittee meetings were held on February 3, 4, and 5, preceding the meeting of the D-11 Committee.

Simon Collier, Johns-Manville Corp., chairman, presided and was assisted by Arthur W. Carpenter, B. F. Goodrich Co., secretary, at the D-11 meeting. The reports of the various subcommittee chairmen, detailed below, were heard first.

It was announced that A. E. Williams, Goodrich, had been appointed chairman of subcommittee 1 on hose; J. A. Williams, Haartz-Mason, Inc., had been appointed to replace S. Tinsey, R. T. Vanderbilt Co., as chairman of subcommittee 24 on coated fabrics; and Henry Peters, Bell Telephone Laboratories, had been appointed to represent Committee D-11 on the subcommittee on rheological properties of Committee E-1 on Methods of Testing.

A representative from Committee D-11 on the E-1 subcommittee on microscopy was also approved, but no member was designated at the meeting.

A committee headed by J. J. Allen, Firestone Tire & Rubber Co., to handle the arrangements for the D-11 advisory committee dinners held at meetings of the Committee was approved.

Symposia on the general subjects of quality control and the statistical design of experiments and processibility of elastomers are being considered for presentation at future annual meetings. Priority is to be given to the symposium on processibility of elastomers.

The "Glossary of Terms Relating to Rubber and Rubber-Like Materials," prepared by the subcommittee on nomenclature and definitions headed by Harry L. Fisher, University of Southern California, is recommended for review by all members of D-11. All suggestions for changes are to be directed to Dr. Fisher.

It was recommended that the subcommittee on standard samples review the problem of developing a standard sample of natural rubber in view of the budget difficulties at the National Bureau of Standards, which had previously agreed to handle this matter.

Members of D-11 were reminded of the Third International Rubber Technology Conference to be held in London, England, during the week of June 21, 1954. Although no meeting of the International Standards Organization, Technical Committee 45 on Rubber, is to be held in 1954, working groups of this organization's Technical Committee 45 will meet in London during the week of June 28. Any members of D-11 attending the Technology Conference are invited to meet with the ISO/TC 45 working groups.

It was pointed out that with the transfer to private industry of the government synthetic rubber plants in 1955, the government specifications for synthetic rubber might, of necessity, be transferred to the jurisdiction of Committee D-11, and provisions for handling this extra work must be considered.

The new commercial standard for coated fabrics as developed by the Society for the Plastics Industry and the Association of Coated Materials Manufacturers, was sent to the American Standards Association for approval. Responsibility for the approval was delegated to subcommittee 24 of Committee D-11 by ASA, with recommendations for representation on this subcommittee from ASTM Committees D-20 on Plastics, D-9 on Electrical Insulating Materials, D-13 on Textiles, and possibly D-1 on Paints.

Mr. Carpenter stated that publication of the D-11 book of "ASTM Standards on Rubber Products," was being held up until letter ballots on a number of testing procedures were obtained, and the next edition of this book could be as up-to-date as possible.

D-11 Subcommittee Meetings

Subcommittee 5—Wire and Cable. John T. Blake, Simplex Wire & Cable Co., chairman. The revised specifications for wire and cable, in which constructional details are contained in separate specifications, were discussed at some length, and certain editorial changes were made. These revised specifications, which represent about five years' work by this subcommittee, are being letter balloted.

It was voted to reduce the specification for tensile strength of colored neoprene jackets in Method D752 to 1600 psi., subject to letter ballot.

There was a discussion of the oil absorption test for polyvinyl chloride insulation and also of the general inadequacy of some short-time accelerated tests.

Subcommittee 6—Packings. F. C. Thorn, Garlock Packing Co., chairman. The section on sheet rubber packing presented a modification of its proposed specification, which is being offered for letter ballot in Committee D-11 as a tentative specification. It supplements and does not conflict with any of the specifications for sheet gasketing contained in Method D1170.

The section on relaxation of commercial gasketing issued a progress report accompanied by an invitation to other members of the subcommittee to engage in some cross laboratory comparisons. The subcommittee chairman presented some figures obtained by the use of a slight modification of the method devised by the section.

Subcommittee 10—Physical Testing. L. V. Cooper, Firestone, chairman. It is recommended that the scope of Method D15 be changed, subject to letter ballot, as follows:

"These methods apply to the procedures for compounding and mixing of certain basic standard rubber compound formulations utilizing standard ingredients together with recommended times and temperatures of cure. They may also be used to prepare mixes of standard compounds, in which one or more of the ingredients are non-standard, or in which all of the ingredients are non-standard. They may also be used when it is desired to substitute a different material for one of the standard materials. However, such substitutions may require changes in the standard mixing and curing procedures."

R. D. Stiehler, NBS, advised that a report on proposed methods for measuring mill roll and stock temperatures might be available at the June meeting.

J. J. Allen gave a report on round-robin tensile, modulus, and elongation tests of buffed samples, using several types of buffing machines and following the procedure outlined in paragraph 20 of Method D15. Although the results were fairly consistent from the 10 laboratories involved, further round-robin tests will be made after obtaining the advice of subcommittee 28 on Statistical Quality Control regarding the design of the experiments.

Subcommittee 11—Chemical Analysis. W. P. Tyler, Goodrich, chairman. The subcommittee voted to submit the new methods for the determination of copper and manganese proposed by the task group headed by N. Bekkedahl, NBS, to Committee D-11 for letter balloting as replacement for sections 50 to 54 of Method D297. Methods of analysis for iron will be submitted by this task group at a later date.

Two proposed changes in section 41 of D297, on ash analysis, were letter balloted in the subcommittee, and objections to one of the proposals developed. A revision of this proposal was agreed upon and the two changes are being submitted to Committee D-11 for action.

A summary of the results of a part of a testing program on analysis of carbon black in rubber compounds was presented, and it was decided that a shorter program involving not more than two methods will be adequate.

In connection with enlarging the usefulness of Method D833 by including absorption spectroscopy techniques for identification of elastomers, it was decided to consult with Committee E-13 on Absorption Spectroscopy regarding the best approach to this problem.

Subcommittee 12 — Crude Natural Rubber. N. Bekkedahl, chairman. C. C. Miller, secretary of the crude rubber committee of The Rubber Manufacturers Association, Inc., described the work of that committee during the past several months. Publication of the RMA "Quality Bulletin" and the booklet on "Natural Rubber Buying" was mentioned. The RMA is trying to encourage continued research on natural rubber in Central and South America, it was said.

The task group on trace metals in rubber is presenting greatly improved procedures for the quantitative determination of copper and manganese in natural rubber to subcommittee 11.

It was decided that subcommittee 12 will

still consider as "harmful dirt" in natural rubber those particles which do not pass through a 325-mesh screen after analysis of rubber samples according to the methods developed for dirt content by the subcommittee.

A task group from subcommittee 28 which is working on a method of sampling bales of rubber met with the subcommittee to discuss the problems involved. Liaison with the RMA crude rubber committee is to be established in this connection.

A task group to study the possibility of developing methods for determining the vulcanization behavior of rubber by means of the Mooney viscometer, with the ultimate view of using data obtained by these means in the classification of natural rubber, was approved.

Subcommittee 14—Abrasion Tests. R. F. Tener, NBS, chairman. R. D. Stiehler, NBS, chairman for the American group, International Standards Organization/Technical Committee 45 on Rubber, reported that ISO/TC 45 has approved the standard for the determination of tear resistance based on ASTM Method D624 using the crescent shaped specimen with a single slit and the standard for abrasion resistance based on ASTM Method D394 using the Du Pont abrader and a constant load. These standards are to be recommended to the ISO Secretariat for approval of the member countries. Some further work on the abrasion standard in connection with the abrasive and the standard compound used is contemplated. Also, the use of constant torque instead of constant load has given evidence of results more consistent with service tests.

The subcommittee will circulate a questionnaire on the needs and difficulties being found with the abrasive used. The ISO/TC 45 program for standardizing the abrasive for the Du Pont machine will be closely followed, and the whole subject considered again at the June meeting.

A revision of Method D394 will be prepared to include the synthetic rubber-carbon black compounds given in Method D15. Requirements for control of the air pressure for cleaning the abrasive at 40 ± 5 psi. in Method B will also be included.

The subcommittee requested that a letter ballot in Committee D-11 on certain changes in Method D624, paragraphs 6b and 9, be made in order to have the latest revision in the next printing of "ASTM Standards on Rubber Products," by Committee D-11.

Subcommittee 15—Life Tests. G. C. Maassen, Vanderbilt, chairman. The proposed specifications of ISO/TC 45 covered by Documents 153, 183, and 201 were discussed, and it was decided to make the following recommendations to the ISO/TC 45 Committee:

Oven Aging. (1) That a maximum limit be set for oven sizes. (2) Substitute the ASTM requirement that the samples do not touch, for the proposed requirement that the samples be separated by one cm. (3) The requirement that the air in the oven not be changed more often than once per hour and no less than once every three hours should be questioned. (4) No differentiation should be made between accelerated and heat aging temperatures, but the temperature of 70° C. and above, which most nearly approximates service conditions, be considered as the accelerated aging test temperature. (5) The time of testing samples should be changed to conform with that in ASTM Methods D573 and D15.

Oxygen Bomb. (1) The construction of the vessel should be made less confining by recommending construction as described in ASTM Method D572. (2) The heating media should include metal as well as liquid. (3) The time of testing samples should be changed to conform with D572 and D15.

In connection with Document 183 on light aging, it was decided that no recommendations would be made to the ISO until corrections have been made in ASTM Methods D518 and D570.

An editorial change in Methods D572 and D865 to permit the use of metal as a heating medium was recommended to Committee D-11.

The subcommittee chairman was authorized to appoint a task group to determine the possibility of using a triangular strip for sunlight aging.

J. E. Norton, Atlas Electric Devices Co., is to define ambient temperature of artificial weathering machines and to recommend a method of measuring this temperature.

Subcommittee 16—Classification and Specifications of Rubber Compounds. J. F. Kerscher, Goodyear Tire & Rubber Co., chairman. At this first meeting of the new subcommittee, the chairman explained the reasons for its formation. An agreement on the proposed scope of the work of the subcommittee was reached, as follows: (1) To prepare standard specifications for the classification of rubber compounds for general use. (2) In the work defined in (1) above, the subcommittee shall cooperate with the ASTM American Group for ISO/TC 45.

The subcommittee chairman was authorized to appoint a task group to outline a program for the long-range undertaking involved in the work of the subcommittee. This task group will meet prior to the June meeting of Committee D-11.

Subcommittee 17—Hardness, Set and Creep. S. R. Doner, Raybestos-Manhattan, Inc., chairman. The unofficial minutes of the working group of ISO/TC 45 Committee on compression set were read. The ISO working group is investigating the effect of thickness to diameter ratio and also the effect of the surface in contact with the specimen, on the duplication of test results. No samples have been received, however, by ASTM for the round-robin testing in this connection.

It was voted to appoint a task group to resolve the question of durometer *versus* ISO hardness scales and report on the possibility or advisability of ASTM eventually adopting the ISO standard for hardness of rubber. The task group is to investigate the effect of one-second to 30-second readings with the "Wallace" hand-test instrument as compared to the "ISO" dead-weight instrument. T. O. Mathues, Inland Mfg. Division, General Motors Corp., is head of this task group.

A task group to investigate the standardization of the Shore Type D durometer was authorized. The Type D durometer is used for determining the hardness of hard rubbers, and other materials having a hardness of 95 or higher on the Shore Type A durometer scale. It was suggested that members of Committees D-9 and D-20 might be invited to become part of a joint task group on this problem.

No action was taken on the suggestion that methods for running compression set tests immersed in various oils and liquids be investigated.

Subcommittee 19—Properties of Rubber and Rubber-Like Materials in Liquids. W. N. Keen, E. I. du Pont de Nemours & Co., Inc., chairman; N. L. Catton, Du Pont, acting chairman for this meeting. Changes aimed at shortening ASTM Method D471 and eliminating duplicating wording in it, which involved rewriting paragraphs 6, 7, 8, 9, and 10, were decided upon. The changes will be letter balloted in the subcommittee. Of particular note were the following:

(1) Paragraph 9b to be deleted since it is no longer being used.

(2) Paragraph 9a to include the following revision: "It is important that all air bubbles clinging to the test specimen be removed before reading the weight in distilled water. If, in the course of determining the immersed weight, air bubbles appear on the surface of the specimen, or the computed volume changes ½% in 5 minutes, or both together, the specimen shall be considered too porous to permit volume determination in this manner. In that case the initial volume of the specimen, if the latter is a simple geometrical solid, can be determined from the overall dimensions by employing an appropriate mensuration formula, and the same procedure shall be followed in determining the volume after the immersion test. Or, if volume increase occurs principally in the thickness dimension, a simple change with thickness may be substituted for change in volume."

The subcommittee authorized the chairman to work with P. J. Smith, ASTM headquarters staff, in preparation of a revised draft of ASTM Method D471.

Subcommittee 20—Adhesion Tests. H. H. Irvin, Marbon Corp., chairman. Subcommittee 28 has formed a task group headed by Henry Peters to assist subcommittee 20 in planning a round-robin test program to investigate the merits of proposed revisions of methods A and B of ASTM D429. It was suggested that for the present the work should be limited to Method B, with one laboratory preparing all assemblies and six laboratories participating in the testing of the samples. The results will be analyzed by Mr. Peters' group before further testing is undertaken. It was agreed that care would have to be taken to devise a rubber compound-adhesive combination which would give failures at the adhesive interface in order to obtain worthwhile data. P. J. Larsen, Lord Mfg. Co., will prepare the test assemblies.

The subcommittee plans to study existing methods for testing the dynamic properties of rubber in order to consider developing standard methods for testing rubber-to-metal bonds under these conditions.

The subcommittee decided to prepare copies of the proposed revisions of methods A and B of ASTM D429 for possible submission to ISO/TC 45 Committee, but to point out that no recommendations on rubber-to-metal adhesion tests can be made by the American Group until the evaluation work now in progress reaches a definite conclusion.

Subcommittee 21—Cements and Related Products. J. F. Anderson, Goodrich, chairman. The task group, headed by G. W. Koehn, Armstrong Cork Co., studying revisions of methods of determining flow in ASTM D1205, reported that the present method is better than other methods studied. An editorial change in section 16, to read as follows, was approved:

"Percentage of flow is influenced by composition of the material, thickness of the film, and the rate of temperature rise of the oven."

The task group headed by A. J. Kearfott, GM Corp., reported that it had accumulated some data on the impact machine method of testing metal-to-metal bonds. Consideration of the impact test method of Committee D-14 was suggested; the task group was asked to develop a proposed method for presentation at the June meeting.

R. G. Westerman, Ford Motor Co., presented pictures and blueprints of test equipment used in a bend test for friction materials bonded to metal. He will submit a proposed test method at the June meeting.

Miss Ethel Levene, Navy Department, Bureau of Ships, asked that the subcom-

mittee study the shelf life of neoprene cements in order to develop an accelerated test for use in place of the present time consuming aging tests.

Subcommittee 23—Hard Rubber. C. P. Morgan, Vulcanized Rubber & Plastics Co., chairman. The asphalt section is continuing its investigation of equipment suitable for the drop-ball impact test. Although no decision on the equipment was made, a proposed apparatus will be circulated among the section members, and agreement by the June meeting is considered possible. It was proposed to define the point of contact of the falling weight on the test specimen, as follows:

"All centers of impingement shall fall within ¼ of an inch of the circle. . . ."

Work is also continuing on the hot and cold cycle requirements and will be reported at a later date. It was decided that more work is necessary on acid absorption characteristics before a satisfactory method can be written.

A review of the proposed additional impact test for hard rubber resulted in further editorial changes, and the revised method is being circulated in the section. A study entitled, "Controllable Variables in the Ball Drop Impact Test," was reviewed.

Analytical results on the determination of soluble iron in hard rubber by a method which provides very good accuracy were presented by P. J. Harriman, Hood Rubber Co., division of Goodrich. The results are being circulated for further comment.

The softening point procedure in ASTM D530 is considered obsolete and will be replaced by the procedure in ASTM D648, if approved by the subcommittee.

The subcommittee chairman reported elongation tests on hard rubber made on the extensometer which appear very satisfactory. A complete report will be presented for subcommittee study.

Subcommittee 25 — Low-Temperature Tests. R. S. Havenhill, St. Joseph Lead Co., chairman. In order to make ASTM D736 conform with ASTM D735 as to testing temperature and not limit the method to any specific test temperature, it was decided (subject to letter ballot in Committee D-11) to delete the last line of paragraph a under apparatus (which specifies temperatures between —40 and —70° F.) and replace it with a reference to a new footnote stating, "Temperatures of —40 and —65° F. are commonly used."

Irving Kahn, U. S. Army Ordnance, reported that at the ISO/TC 45 Committee meeting, which he attended in Paris, France, in June, 1953, he recommended that ASTM Methods D676 on hardness, D1053 on stiffness, D746 on brittleness, and D1229 on compression set, be considered for adoption as ISO standards. At this meeting the United States was made coordinator for low-temperature test work on rubber, and Mr. Kahn was delegated to head this work.

As suggested by Mr. Carpenter and others, it was voted to have the section on the temperature-retraction test headed by O. H. Smith, United States Rubber Co., revise the scope of this method to include information on why the method was useful and the limitations of it. In this connection, H. G. Bimmerman, Du Pont, suggested that reference be made to the material in ASTM D832 concerning the changes which take place when rubber compounds are subjected to low temperature, in order to explain how the TR test fits into the picture.

R. C. Boyd, Bakelite Corp., reported that the latest revision of ASTM D746 does not delete the statistical end point, but does include the "go-no-go" provision requested by SAE-ASTM Technical Committee on Automotive Rubber and subcommittee 25. Mr. Catton reported that section 4L of Technical Committee A had approved this latest draft of D746 and would letter ballot on the replacement of D736 by D746 in D735.

The suggestion of D. C. Scott, Jr., Scott Testers, Inc., that a total specimen width not greater than ½-inch be recommended for testing such materials as polyethylene, polyvinyl chloride, etc., with the Scott solenoid machine, was referred to Committee D-20 on Plastics, which has jurisdiction over ASTM D746.

Bruce Lewis, Tinius Olsen Testing Machine Co., discussed some of the factors which cause the wide difference in results obtained when motor-driven equipment is used for the D746 test. These factors included variation in the speed of the striker arm, angle of bend of specimens, distance between striking arm and specimen holder, position of seat of specimen with relation to striker arm, and contour of striker arm and sides on some machines.

Subcommittee 26 — Processibility Tests. Rolla H. Taylor, Scott Testers, chairman. The investigation of the new types of dies and rotors for the Mooney viscometer, previously reported by NBS,[1] has been organized under Ross Shearer, Goodrich, and a report is expected at the June meeting.

George E. Decker, NBS, advised that the experience of the Reconstruction Finance Corp. to date indicates no difficulties from use of the new-type dies, but that the new-type rotors may cause slippage in some cases.

Report of American Group for ISO/TC 45 Committee

Since the 1953 annual meeting of ASTM, the American Group for ISO/TC 45 on Rubber has been organized. The Group comprises 23 members, representing American Standards Association, ASTM Committee D-11 and its various subcommittees responsible for methods of test being standardized by ISO/TC 45, and the United States representatives on ISO/TC 45 working groups. R. D. Stiehler is chairman of the Group.

The Group has submitted through ASA a document on the Technical Classification of *Hevea* Rubber and one containing comments on ISO/TC 45 Document 181 on ozone testing. A working group on low-temperature tests, for which the United States is the coordinator, is being organized.

SAE-ASTM Technical Committee on Automotive Rubber

The SAE-ASTM Technical Committee on Automotive Rubber has held two meetings since the June, 1953, meeting of ASTM, it was reported by J. J. Allen, Firestone, chairman of Technical Committee A. The following actions were approved by letter ballot in the Committee:

1. The specification with a revised title, "Rubber 'O' Rings for Automotive Seal and Packing Applications," will be published by SAE only.

2. "Bench Leakage Test for Automotive Oil Seals" is to be changed in section 4, paragraph 1, in connection with qualification test, from a period of 500 hours to 236 hours.

3. A revision of SAE 40-5-3 on "Vacuum Brake Hose" to include light-duty hose and revision of ASTM Method D622 on Testing Vacuum Brake Hose.

4. A revision of ASTM Method D735-52 aT and SAE 10R, suffix letter L in Table 5, water absorption time and temperature. A change in volume change limits and a change in the wording of paragraph 6f(1), suffix letter L, which involved removal of the word "fresh" (distilled water) from the last sentence.

[1] See India Rubber World, June, 1953, p. 339.

Mr. Allen requested that Committee D-11 letter ballot the requested revisions in ASTM D622 and D735.

One negative vote in the Technical Committee on revisions in ASTM D1170, Non-Metallic Gaskets for General Automotive Purposes, pointed out that SAE uses standard fuels #1 and #2; while ASTM refers to fuels A and B. No action has been taken by the Technical Committee on this negative vote as yet.

A revision of V-Belts and Pulleys and Recommended Practice for V-Belt Drives has been completed, but since this is an SAE specification only, no action by ASTM is requested.

The advisory section of the Technical Committee has suggested revisions in the organization of the Committee which are being considered by the rules and membership section.

Section 1 on vibration insulators has completed a round-robin test program to determine the reproducibility of the Yerzley oscillograph method for resilience, ASTM D1207, and the data are being compiled.

Section 3 on automotive hose prepared a revision of SAE 40-R3 and ASTM D622 to provide for light-duty vacuum brake hose and methods of testing, and these revisions have been approved by the Technical Committee, as mentioned above.

Section 4 prepared revisions of suffix letter L in ASTM D735, which have also been approved. A revision of suffix letter K into K_1 on adhesion of rubber to metal during vulcanization, and K_2 on adhesion of rubber to itself or other material, is being letter balloted in the section and the Technical Committee.

Section 6 worked out a final draft of the proposed V-belt and pulley specification, which has been approved.

Section 10 on gaskets recommended some revisions in SAE 9R and ASTM D1170, but the one negative vote makes it necessary to clarify the situation on the SAE *versus* ASTM fuels.

Section 11 did the work on the bench leakage qualification test mentioned above. Other revisions are also being considered.

Section 13 on finish standards is developing means of indicating by standard notes on blueprints the type of finish required for molded and extruded rubber articles.

TLARGI Technology Course

BASIC RUBBER TECHNOLOGY B, a non-credit course that is a detailed and moderately advanced continuation of Rubber Technology Course A of last fall, began on February 11 under the sponsorship of the Los Angeles Rubber Group, Inc. Held at the University of Southern California, the course is intended to provide general information to production, sales, administrative, and technical personnel on all phases of natural and synthetic rubber product manufacture, and on latex compounding, carbon black usage, oil masterbatches, and statistical quality control. Qualified guest speakers will cover these subjects over the 14 sessions, and plant visits will be scheduled for the students by Class Director J. L. Ryan.

Rubber Division, A. C. S., Louisville Meeting To Feature Kentucky Hospitality

THE spring meeting of the Division of Rubber Chemistry of the American Chemical Society, to be held separately from the parent Society at the Brown Hotel, Louisville, Ky., April 14-16, will provide a chance for members and guests to visit Louisville's famed "Rubbertown" where three kinds of chemical rubber, GR-S, neoprene, and Hycar, are produced and to enjoy Kentucky hospitality at its best during leisure hours.

Three technical sessions are planned for Wednesday afternoon, April 14, and Thursday and Friday mornings. Abstracts of the papers will be presented in the trade journals, and reprints will be available at the registration desk at the meeting. A ladies' program including trips to nearby points of interest in "Old Kentucky" has also been planned.

Trips to the Du Pont neoprene plant and the GR-S plant of the Kentucky Synthetic Rubber Corp. are scheduled for Thursday afternoon, April 15. Trips are also scheduled to Brown-Forman Distillers Corp. and the new General Electric Appliance Park where General Electric is concentrating the production of all its major appliances.

The principal speaker at the Division banquet on Thursday evening will be Clarence E. Manion, former dean of the Notre Dame College of Law and ex-chairman of President Eisenhower's Committee on Inter-Governmental Relations. Dean Manion will speak on governmental encroachment on civil rights and personal liberties, and an excellent talk may be expected. He is the author of a number of books and brochures, the most recent of which is "The Key to Peace," which has been adopted by the American Legion for distribution to high schools throughout the country as a part of its Americanization program. Dean Manion was awarded a medal by the Freedoms Foundation in 1949 and again in 1950 for his speeches and writings on the subject of Americanism.

Dinner music will be played by the South's leading organist, and other light entertainment plus a few little surprises are promised for the Rubber Division's banquet.

The ladies' program includes a trip on Wednesday afternoon to Brown-Forman Distillers Corp., followed by Churchill Downs, which will not be "running," but will be getting spruced up for the Kentucky Derby. On Thursday there will be a choice of a trip to nearby Bardstown or visits to local points of interest. At Bardstown visits will be made to Federal Hill, where, in 1852, Stephen Foster wrote "My Old Kentucky Home"; Wickland, the "Home of Three Governors" built in 1813; St. Joseph's Cathedral, which contains paintings by Old Masters presented by Louis Philippe, later King of France; and lunch at Talbot Inn, one of the earliest in Kentucky.

The opportunity to participate in the local radio program, "Coffee Call," followed by a tour of WHAS and WHAS-TV radio and television studios and the modern newspaper plant of the *Courier-Journal*, will be available to the ladies every morning; "official" on Thursday.

Members of the Division will receive registration cards in the mail. Others interested in attending this meeting can obtain advance registration information from T. R. Linak, B. F. Goodrich Chemical Co., Box 954, Louisville 1, Ky.

New Copolymers with Built-in Plasticizer

NEW vinyl chloride copolymers in which one of the monomers involved, vinyl stearate, provides built-in plasticizing action have been developed by the Eastern Utilization Research Branch of the Agricultural Research Service, United States Department of Agriculture. Obtained from inedible animal fats, the vinyl stearate is chemically bound and cannot migrate or evaporate from the copolymer.

The new copolymers may be rigid or flexible, depending on the vinyl stearate content. Copolymers with a high vinyl stearate content are similar in flexibility, elongation, tensile strength, and other physical properties to standard vinyl chloride compounds made with commercial plasticizers. Copolymers with a low vinyl stearate content are essentially rigid and have a lower milling temperature and lower bulk viscosity temperature coefficient than do currently available commercial vinyl resins. These advantages make them easier to handle in such operations as calendering, molding, and extrusion because less stringent control of pressure and temperature is required.

Both rigid and flexible types of the new copolymers can be cured with polyfunctional amines to give infusible, insoluble resins. Compounding and preforming can be accomplished at temperatures of about 200° F.; while curing is done at about 340° F. The flexible type of copolymer retains much of its flexibility after curing.

Further information on the preparation and properties of the new copolymers is given in a new USDA publication, AIC-366, entitled, "Vinyl Plastics Modified with Chemicals from Animal Fats. Copolymers of Vinyl Chloride and Vinyl Stearate." Copies and samples of the copolymers may be obtained from the Eastern Branch at Philadelphia 18, Pa.

Akron Group Carbon-Black Symposium Well Attended

THE symposium on "The Manufacture and Application of Carbon Blacks," which was the feature of the mid-winter meeting of the Akron Rubber Group held at the Mayflower Hotel, Akron, O., attracted an attendance of 500 members and guests. The afternoon panel discussion meeting was followed by a cooperative cocktail party held by the carbon-black supplier companies and by the Group dinner-meeting attended by more than 600. Entertainment after dinner was provided by Edwin L. Baron, master hypnotist.

The panel of experts on various phases of carbon black manufacture and use was composed of eight representatives of supplier companies, with R. P. Dinsmore, vice president, Goodyear Tire & Rubber Co., as moderator. Each of the panel members gave a short talk and then answered questions previously sent to the Group by members and guests.

The panel members, their company affiliations, and the subject or type of black covered, were as follows: C. A. Carlton, J. M. Huber Corp., **The Manufacture of Channel, Gas Furnace and Oil Furnace Carbon Blacks;** G. C. Maassen, R. T. Vanderbilt Co., **Thermal Blacks;** I Drogin, United Carbon Co., **SRF Blacks;** Leslie Carver, Witco Chemical Co., **HMF Blacks;** Merton Studebaker, Phillips Chemical Co., **HAF Blacks;** John Snyder, Binney & Smith Co., **SAF and ISAF Blacks;** F. H. Amon, Godfrey L. Cabot, Inc., **FEF Blacks;** and L. E. Sperberg, Sid Richardson Carbon Co., **Channel Blacks.** [The talks and the 50 or more questions and answers covered by the panel and the moderator will appear in an early issue of India RUBBER WORLD—EDITOR.]

At the business session following dinner it was announced that the executive committee of the Group had approved plans for establishing four annual $250 scholarships on rubber at the University of Akron. The scholarships will be financed from the treasury and a 50¢ increase in the annual dues and will cover one scholarship each year for the freshman, sophomore, junior, and senior years. A vote on the scholarship plan will be taken at the next meeting of the Group. Membership of the Akron Group now totals 1,503.

The slate for 1954-55 officers was presented by L. A. Baker, General Tire & Rubber Co., chairman of the nominating committee, as follows: chairman, V. L. Petersen, Goodyear; vice chairman, Fred Gage, Columbia Southern Chemical Corp., and Ken Garvick, Firestone Tire & Rubber Co.; secretary, Harry Brubaker, Witco, and Karl Brandau, Firestone; treasurer, H. D. Harrington, General Tire & Rubber Co., and John H. Gifford, The B. F. Goodrich Co.

The door prizes of $15 and $10 in silver for the meeting were won by Fred E. Mech, McCreary Tire & Rubber Co., and Ora A. Young, Ohio Rubber Co., respectively.

AIEE on Rubber and Plastics

THE sixth annual conference on rubber and plastics will be held by the American Institute of Electrical Engineers at the Mayflower Hotel, Akron, O., April 5-6. Tentative program for the meeting, following a keynote address by John Grotzinger, Goodyear Tire & Rubber Co., is given below.

April 5: **"Training Young Engineers,"** Arthur Carpenter, The B. F. Goodrich Co.; **"Magnetic Clutches and Brakes for Rubber and Processing Machine Drives,"** A. E. Lillquist, Cutler-Hammer Corp.; **"Preventive Maintenance of Large Electric Motors and Controls in Rubber Mills,"** Kurt John, United States Rubber Co.; **"High-Voltage Motor Controllers for the Rubber Industry,"** F. J. Render, General Electric Co.; and **"Selection of Drives for the Continuous Processing of Plastic Films,"** A. G. Payne, Monsanto Chemical Co.

April 6: **"Recent Developments in Insulation of Large Electrical Machines,"** G. L. Moses, Westinghouse Electric Corp.; **"Magnetic Amplifiers for the Rubber and Plastic Industries,"** John Santer, Clark Controller Co.; and **"Today's Challenge in Human Relations,"** B. H. Taylor, Goodrich.

Following the second session (April 6) which will be held in the morning, arrangements have been made for an inspection trip through Plant 2 of the Firestone Tire & Rubber Co.

Additional Experimental GR-S Polymers and Latices

THE additions and changes in the list of experimental GR-S polymers and latices authorized by the Office of Synthetic Rubber, Reconstruction Finance Corp., during the period from July 1, 1953, to December 31, 1953, are given in the table below.

In addition, there was made public the following list of currently active experimental polymers, availability of which should be ascertained at the time of ordering by inquiring of the sales division of OSR: GR-S latices—X-617, -633, -667, -684, -710, -711, -734, -753, and -758; and GR-S solid polymers—X-754 and -757. Also announced was the change in designation of GR-S X-733 to GR-S 1602 and of GR-S X-695 to GR-S 2006.

Normally, experimental polymers will be produced only at the request of the consumers, and 20 bales (one bale weighs approximately 75 pounds) of the original run will be set aside, if possible, for distribution to other interested companies for their evaluation. The 20 bales, when available, will be distributed in quantities of one bale or two bales upon request to the OSR sales division, or will be held for six months after the experimental polymer was produced, unless otherwise consigned before that time. Subsequent production runs will be made if sufficient requests are received.

All of these new polymers are experimental only, and the OSR does not make any representations or warranties of any kind, express or implied, as to the specifications or properties of such experimental polymers, or the results to be obtained from their use.

X-Number Designation	Polymer Description	Remarks
X-755 GR-S	A masterbatch of 37.5 parts aromatic-type processing oil (Socony-Vacuum XT-784-X) and 100 parts base polymer. Polymer: 23.5% bound styrene; sugar-free iron activated; 50/50 rosin/fatty acid soap emulsified; 41° F. reaction temperature; 60% conversion; carbamate shortstop; staining antioxidant; salt-acid coagulated. Mean raw Mooney viscosity of masterbatch, 55 ML-4 at 212° F.	Similar to GR-S 1710. Established for a single production run only to permit consumer evaluation so as to obtain consumers' approval as to the interchangeability of the Socony-Vacuum XT-784-X with the aromatic-type processing oils already accepted.
X-756 GR-S	A masterbatch of 37.5 parts aromatic-type processing oil (Sinclair Extract P-128) and 100 parts base polymer. Polymer: same as for X-755 GR-S. Viscosity: same as for X-755 GR-S.	Same as for X-755 GR-S except the single production run was for approval of interchangeability of Sinclair Extract P-128 with accepted aromatic-type oils.
X-757 GR-S	A masterbatch of 25 parts aromatic processing oil and 100 parts base polymer. Polymer: 23.5% bound styrene; persulfate catalyzed; fatty acid soap emulsified; 122° F. reaction temperature; 68% conversion; carbamate shortstop; staining antioxidant; salt-acid coagulated. Mean raw Mooney viscosity of masterbatch, 48 ML-4 at 212° F.	An oil masterbatch prepared from a high Mooney "hot" GR-S type of polymer and an aromatic-type processing oil.
X-758 GR-S Latex	Butadiene/styrene charge ratio 70/30 adjusted to yield 25 ± 2.0% bound styrene; sulfoxylate activated; 65/35 rosin/fatty acid soap emulsified; 50° F. reaction temperature; 60% conversion; carbamate shortstop; potassium oleate stabilized. Mean Mooney viscosity of contained polymer 140 ML-4. The latex is heat concentrated to 60.0% minimum total solids.	Similar to GR-S X-619 except for the sodium formaldehyde sulfoxylate activated system, instead of sugar-free iron, which results in a latex with a better color. *Has replaced X-619.*
X-711 GR-S Latex	Polymer is now shortstopped with carbamate instead of mercaptobenzothiazole.	

Panel Discussion on Oil-Resistant Rubbers

A PANEL discussion on "Oil-Resistant Synthetic Rubbers" highlighted the February 11 dinner-meeting of the Fort Wayne Rubber & Plastics Group, held in the Hotel Van Orman, Fort Wayne, Ind., with 152 members and guests attending. H. G. Crosland, Chicago Rawhide Mfg. Co., acted as moderator, and the panel members were E. D. Cunningham, Precision Rubber Co.; R. W. Malcolmson, E. I. du Pont de Nemours & Co., Inc.; and N. G. Duke, The B. F. Goodrich Co. Short talks were given by the moderator and panel members, after which the speakers answered questions from the floor.

In introducing the subject Mr. Crosland briefly reviewed the various synthetic rubber polymers available to the compounder, mentioning some of the characteristics of each type. These polymer classes and the specification tables in ASTM D735 which they can be compounded to meet are as follows: polysulfides, table SA; nitrile rubbers, table SB; chloroprenes, table SC; polyacrylates, table TB; and silicone rubbers, table TA. The trifluorochloroethylene and tetrafluoroethylene resins are used essentially as modifying agents for the other rubbers.

The next speaker, Mr. Cunningham, discussed "Rubber—A Dynamic Engineering Material." The diversity and the scarcity of engineering information on rubber, coupled with the prevalence of misinformation, have created a demand for specifications which is being met in part by ASTM D735. This specification is only descriptive or qualifying and does not give the fundamentals of using a resilient material or tell the engineer how to apply these fundamentals to the solution of a design problem, Mr. Cunningham declared. Most mechanical applications involve properties seldom measured, such as snapback, resiliency, hysteresis, creep, effect of temperature on physicals, modulus at low elongation-low tension loads, and Joule factor (work factor related to temperature). These factors were discussed by the speaker, and comparative values given for *Hevea*, Butyl, neoprene, and GR-S snapback and resiliency properties.

Mr. Malcolmson, the third speaker, discussed "Neoprene's Place in the Oil Resistant Rubber Field." He divided the neoprenes into general-purpose (Types GN, GN-A, GRT, W, WRT, and WHV) and special-purpose (Types AC, CG, KNR, Q, and S) polymers and gave brief descriptions of their properties. A general comparison of neoprene and nitrile rubbers concluded the talk, and Mr. Malcolmson pointed out that these polymers are complementary and not directly competitive.

The concluding talk, "Oil Resistance of Nitrile Rubber," was given by Mr. Duke and was similar to the article of the same title by Duke and W. A. Mitchell which appeared in our July, 1953, issue, page 485.

Tlargi Meeting Hears Sears

A TOTAL of 261 members and guests of The Los Angeles Rubber Group, Inc., attended a regular meeting on February 2 at the Hotel Statler, Los Angeles, Calif. The meeting included an afternoon technical session at which W. J. Sears, The Rubber Manufacturers Association, Inc., spoke on "Natural Rubber Quality and Supply," a cocktail hour, and dinner meeting. Mr. Sears' talk was devoted to the work of the RMA on rubber quality, and an analysis of the natural and synthetic rubber supply outlook. Similar talks were given by the speaker before meetings of the Rhode Island Rubber Club on November 19[1] and the Philadelphia Rubber Group on January 22 (reported elsewhere in this issue).

The after-dinner speaker was S. E. Roll, District Attorney of Los Angeles County, who discussed the "Activities of the District Attorney's Office."

In the business session, life membership certificates, the Group's highest award, were presented to R. D. Abbott, R. D. Abbott Co.; T. Kirk Hill, Kirkhill Rubber Co.; David Spence, retired; and Harry L. Fisher, Tlargi Rubber Technology Foundation. A certificate of appreciation was given to D. C. Maddy, Harwick Standard Chemical Co., for his work as chairman during the past year.

Other business activities included the approval of a change in the Group's by-laws; distribution of the "1954 Tlargi Yearbook" by Committee Chairman W. M. Anderson, Gross Mfg. Co.; and the announcement by F. C. Johnston, Caram Mfg. Co., that the annual outing will be held at the Hotel Miramar, Santa Barbara, on June 12-13.

Door prizes contributed by the Group were won by C. E. Wilson, Pacific Moulded Products Co.; Gene Ostman, P. B. Division, Byron-Jackson Co.; Bud Burson, H. M. Royal, Inc.; Fred Shor, Fargo Rubber Corp.; Wayne Churchill, Ideal Roller & Mfg. Co.; John Tidgewell, Anaconda Wire & Cable Co.; and Bud Budnick, Ohio Rubber Co.

[1] See our Dec., 1953, issue, p. 367.

California Group Elections

NEW officers of the Northern California Rubber Group were announced at the February 11 dinner-meeting, held in the Berkeley Elks Club, Berkeley, Calif. The officers are: president, Jim Stull, Mansfield Tire & Rubber Co.; vice president, Halsey C. Burke, Burke Rubber Co., Inc.; secretary, Gene Gador, Oliver Tire & Rubber Co.; and treasurer, Stan Mason, Pioneer Rubber Mills.

There were 34 members and guests present at the meeting, which also included an after-dinner illustrated talk on "Fishing and Hunting in Montana" by Robert Robard, naturalist and professional guide for the State of Montana.

Raincoat Materials Compared

THE February 16 meeting of the Elastomer & Plastics Group, Northeastern Section, American Chemical Society, featured a round-table discussion of "Materials and Methods for Production of an Ideal Raincoat." John B. Gregory, Frederick S. Bacon Laboratories, acted as moderator, and the panel members were Wilhelm A. Appeltofft, Plymouth Rubber Co.; F. A. Newman, A. J. Tower Co.; Ernest R. Kaswell, Fabric Research Laboratories; and Kenneth A. Winkley, Hodgman Rubber Co. Approximately 75 members and guests attended the meeting, which was held at Massachusetts Institute of Technology, Cambridge, Mass., and preceded by a dinner at Smith House.

The discussion took the form of a directors' meeting of a hypothetical company planning to produce 100,000 units of a man's raincoat. Each panel member advocated a different type of raincoat, giving costs, production operations, construction details, and desirable characteristics of his particular type of coat.

Mr. Appeltofft outlined the problems involved in the manufacture of a six-gage vinyl raincoat, stressing the coat's low cost, bright color possibilities, waterproofness, and general appeal and utility. Mr. Newman discussed the production of raincoats made from oilskins and latex dipped fabrics, pointing out the similarity in processing methods. Both types of coats were claimed to be completely waterproof because of the post-fabrication dips used to seal up the stitching holes.

The relative merits of natural and synthetic fabric raincoats were discussed by Mr. Kaswell, who compared strength and tear properties, hygroscopic characteristics, draping, and cost factors of nylon, acrylic fibers, rayon, silk, wool, and cotton. Cloth coats were held to be the most comfortable, and cotton the most suitable material for the average raincoat.

The final panel speaker, Mr. Winkley, discussed two types of proofed goods recommended for raincoat use: calendered natural rubber on cotton for outside coating, and spread polyvinyl butyral on nylon for inside coating. Both types were reviewed as to costs and fabrication techniques, using both vulcanization and self-curing cementing methods. The light weight and style of this type of coat were stressed.

Mr. Gregory summed up the panel discussion, tabulating the statistics given by the speakers with regard to weights, costs, and characteristics. A lively open discussion period followed, and it was generally agreed that similar round-table meetings should be held in the future.

Colors Discussed at Quebec

A TALK on "Colors for the Rubber Plastics Industry" by L. R. Sherman, Imperial Paper & Color Corp., featured the January 21 dinner-meeting of the Quebec Rubber & Plastics Group. The meeting was held at the Queen's Hotel, Montreal, P. Q., and attracted 88 members and guests.

Ladies' Night

The February 22 meeting of the Group was the annual Ladies' Night, held at Victoria Hall, Westmount. A total of 225 members, guests, and their wives attended the event, which included a dinner and an evening of dancing. Each lady was presented with a corsage, and 40 door prizes donated by the Group were awarded.

Thiokol Technical Club Hears About Elastomers on Ships

THE quantity of rubber used on naval vessels (75,000 pounds for aircraft carriers; 48,000 pounds for submarines) is not an impressive figure when compared with the total tonnage, but its importance to long and proper functioning of the ship more than compensates for the small physical percentage. For this reason, specifications are set up by the Navy to insure the effectiveness of rubber products used in these capacities.

Some of the problems encountered in this respect were discussed on February 18 by T. A. Werkenthin, head of the elastomer branch of the Navy Department's Bureau of Ships, in an address before 175 members and guests of the Thiokol Technical Club at Thiokol Chemical Corp.'s offices in Trenton, N. J. Entitled, "Some Elastomer Applications on Naval Vessels," the address was devoted primarily to use of elastomers as underwater and protective coatings for various installations and was illustrated with slides. A film, "Testing Rubber Products," which demonstrated some of the tests to which rubber is subjected before acceptance for use in the products, was also exhibited.

Mentioned as presently being employed for protecting rudders and drive shafts against corrosion and cavitation was a polysulfide material which hardens on the metal surface after being applied by flame spraying. Sheeted neoprene attached to the metal with cement is being considered as a replacement, however, because it permits application by less skilled labor. Weather decks, especially those of aircraft carriers, are being coated with high impact and flame resistant blends of acrylonitrile-phenolic resin polymers. Calking compounds of Thiokol liquid polymers and battery compartment linings of acid-resistant vulcanized sheet rubber were discussed. The application of rubber in driving mechanisms (water-lubricated bearings and bearing strips made of acrylonitrile) and for miscellaneous duties was also covered.

Preceding the address, the gathering was treated to a cocktail party and excellent turkey dinner by the chemical company.

High-Polymer Group Elects

THE Division of High-Polymer Physics, American Physical Society, recently elected the following officers for 1954: chairman, John D. Ferry, University of Wisconsin; vice chairman, Robert S. Marvin, National Bureau of Standards; and secretary-treasurer (reelected), W. James Lyons, Firestone Tire & Rubber Co. Elected to three-year terms on the executive committee were Herman F. Mark, Polytechnic Institute of Brooklyn, and Dr. Lyons.

A.I.Ch.E. Meeting in May

THE spring national meeting of the American Institute of Chemical Engineers will be held in Springfield, Mass., at the Kimball Hotel, on May 16-19. Included in the program will be a forum on "Training of Technical Men in Industry"; symposia on "Polymeric Materials of Construction," "Cost Control," and "Process Design"; and general technical sessions.

Outlook for Natural Rubber

A TALK on "Natural Rubber Quality and Supply" by W. J. Sears, vice president of The Rubber Manufacturers Association, Inc., and chairman of the RMA Crude Rubber Committee, highlighted the January 22 dinner-meeting of the Philadelphia Rubber Group. Held at the Poor Richard Club, Philadelphia, Pa., the meeting attracted an attendance of 109 members and guests, who heard the speaker describe the activities of the RMA and its Crude Rubber Committee in standardizing type descriptions.

In discussing the outlook for rubber, Mr. Sears expressed the opinion that GR-S prices will not be raised since the RFC had a net profit of nearly $60,000,000 in the last fiscal year and is operating on a very profitable basis in this fiscal year. In addition, the government is averse to using GR-S prices to manipulate the value of a commodity (natural rubber) sold in international trade. With synthetic rubber under private operation, most evidence indicates that there might be a slight price increase at the outset of such operation, followed by a lower price as companies expand capacity and improve efficiency.

The speaker declared that, contrary to some opinions, the leaders and governments of the natural rubber producing countries look forward to free competition between natural and synthetic rubber when the synthetic plants are owned by private industry. Under these conditions many have stated that they foresee no need of international agreements, and that the competition between the two privately owned rubbers will solve their problems. This competition will force the natural rubber industry to improve its efficiencies and result in better quality and uniformity of rubber as well as improved economic conditions in southeast Asian countries.

New officers elected by the Group for the coming year are: chairman, A. J. DiMaggio, Firestone Tire & Rubber Co.; vice chairman, M. A. Youker, E. I. du Pont de Nemours & Co., Inc.; and secretary-treasurer, L. E. White, Walker Bros. Directors are as follows: one year—L. J. Dete (Carlisle Tire & Rubber Division, Carlisle Corp.), R. M. Harper (Aeronautical Materials Laboratory, U. S. Naval Base Station), and G. J. Wyrough (Wyrough & Loser, Inc.); two years—G. H. Brannan (Binney & Smith Co.), J. R. Mills (Whitehead Bros. Rubber Co.), and A. L. Shaw (B. F. Goodrich Co.); three years—P. Noble (Cambridge Rubber Co.) and B. A. Wilkes (Godfrey L. Cabot, Inc.).

Selling Safety to Employes

SAFETY is the hardest thing in the world to sell, according to Tom J. Cain, director of safety for The B. F. Goodrich Co., speaking before 185 members and guests of the Chicago Rubber Group at a dinner-meeting on February 5 at the Congress Hotel, Chicago, Ill. Safety is boring to employes until they realize the dangers of not being safe at all times, and such realization requires sales showmanship in the form of gimmicks, stunts, gags, and contests to make the worker safety-conscious. It can be proved that incentives are necessary for a successful safety program, and their cost will be less than the money saved in lower accident insurance rates and greater output per man.

Mr. Cain noted that safety in this country has gone through four stages: (1) the period of awakening to the dangers of un-

safe operation in industry; (2) the period of installing guards on hazardous machinery; (3) the period of enforcement of safety regulations by state governments; and (4) the period of training employes to be safe at all times. We are now in the fourth period, which is where most companies are making really effective strides in eliminating accidents, the speaker declared.

In the business session preceding the talk, reports were given by Bert Vandermar, Acadia Synthetic Products Division of Western Felt Works and educational committee chairman; Ben Yunker, Chicago Rawhide Mfg. Co. and Christmas party committee chairman; and Harold Stark, Dryden Rubber Division of Sheller Mfg. Co., on the actions of the directors. Herman Boxser, Arcadia Synthetic, was appointed chairman of the nominating committee for new Group officers.

It was also announced that the March 26 meeting will be "Old Timers' Night" in celebration of the Group's twenty-fifth anniversary.

Conn. Group Installs Officers

THE installation of 1954 officers of the Connecticut Rubber Group took place at the February 12 dinner-meeting, held at the Hotel Barnum, Bridgeport, with 85 members and guests in attendance. The new officers are: chairman, G. A. DiNorscia, Sponge Rubber Products Co.; vice chairman, Ward Fisher, Armstrong Rubber Co.; secretary, James R. Boyle, also of Armstrong; and treasurer, Harry Gordon, Bond Rubber Co. New directors of the Group are E. J. Butler, General Electric Co.; Lyle Longworth, Monsanto Chemical Co.; A. Panagrossi, Connecticut Hard Rubber Co.; F. J. Rooney, G-E; and A. Schorr, R. T. Vanderbilt Co.

The meeting also featured a showing of the Midwest Rubber Reclaiming Co. film, "Behind the Scenes," which illustrates the manufacturing process for reclaimed rubber. The film commentary was given by Richard Zogg, of Midwest, who also answered questions from the floor.

Atomic Energy Talk for Akron

THE spring dinner-meeting of the Akron Rubber Group, to be held April 2 at the Mayflower Hotel, Akron, O., will feature a talk by Hubert N. Alyea, associate professor of chemistry at Princeton University on "Atomic Energy—Weapon for Peace." Dr. Alyea has studied in Germany, Sweden, and the United States, has taught also at the University of Hawaii, and has received the New Jersey Science Teachers Award (1950).

Boston Ski Outing

THE annual ski outing of the Boston Rubber Group took place February 5-7 at the Bartlett Hotel, Bartlett, N. H. Thirty-seven members and guests participated, and the only casualty was Robert Hathaway, C. K. Williams Co., who suffered a wrenched knee on February 6. Snow conditions were fair, and most of the skiing was done on Black Mountain, Thorne Mountain, and Cranmore. Despite the relatively warm weather, 40° F., it was generally agreed that the outing was one of the most enjoyable that was ever held in the series.

CALENDAR

Mar.	18-20.	**Division of High Polymer Physics, APS. Detroit and Ann Arbor, Mich.**
Mar.	22-24.	**Committees D-9 and D-20, ASTM. Roanoke Hotel, Roanoke, Va.**
Mar.	25.	**Southern Ohio Rubber Group. Symposium on Synthetic Rubber Polymerization. Engineers Club, Dayton, O.**
Mar.	26.	**Boston Rubber Group. Spring Meeting.**
		Chicago Rubber Group, Inc. Furniture Club, Chicago, Ill.
Apr.	2.	**Akron Rubber Group. Mayflower Hotel, Akron, O.**
		New York Rubber Group. Henry Hudson Hotel, New York, N. Y.
Apr.	6.	**The Los Angeles Rubber Group, Inc. Hotel Statler, Los Angeles, Calif.**
Apr.	8.	**Fort Wayne Rubber & Plastics Group. Van Orman Hotel, Fort Wayne, Ind.**
		Northern California Rubber Group.
Apr.	9.	**Detroit Rubber & Plastics Group, Inc. Detroit Leland Hotel, Detroit, Mich.**
Apr.	14.	**Newark Section, SPE. Military Park Hotel, Newark, N. J.**
Apr.	14-16.	**Division of Rubber Chemistry, A. C. S. Brown Hotel, Louisville, Ky.**
Apr.	21.	**New York Section, SPE. Hotel Gotham, New York, N. Y.**
		Washington Rubber Group.
Apr.	30.	**Chicago Rubber Group Inc. Furniture Club, Chicago, Ill.**
May	4.	**The Los Angeles Rubber Group, Inc. Hotel Statler, Los Angeles, Calif.**
May	12.	**Newark Section, SPE. Military Park Hotel, Newark, N. J.**
May	13.	**Northern California Rubber Group.**
May	14.	**Connecticut Rubber Group.**
		Buffalo Rubber Group. Joint Meeting with Canadian rubber groups. General Brock Hotel, Niagara Falls, Ont., Canada.
May	16-19.	**American Institute of Chemical Engineers. Spring National Meeting. Kimball Hotel, Springfield, Mass.**
May	17-20.	**Second Basic Materials Exposition and Conference. International Amphitheatre, Chicago, Ill.**
May	19.	**New York Section SPE. Hotel Gotham, New York, N. Y.**
		Washington Rubber Group.
June	5.	**Southern Ohio Rubber Group. Summer Outing.**
June	8.	**Buffalo Rubber Group. Summer Outing. Transit Valley Country Club, East Amherst, N. Y.**
June	9.	**Newark Section, SPE. Military Park Hotel, Newark, N. J.**
June	10.	**New York Rubber Group. Outing. Doerr's Grove, Millburn, N. J.**
June	11.	**Fort Wayne Rubber & Plastics Group. Summer Outing.**
June	12-13.	**The Los Angeles Rubber Group, Inc. Summer Outing. Hotel Miramar, Santa Barbara, Calif.**
June	14-18.	**American Society for Testing Materials. Annual Meeting. Sherman and Morrison Hotels, Chicago, Ill.**
June	18.	**Akron Rubber Group. Outing.**
		Boston Rubber Group. Summer Outing.
June	20-24.	**American Society of Mechanical Engineers. Pittsburgh, Pa.**
June	21-25.	**International Rubber Technology Conference. London, England.**

Peroxides from Gum Rosin

A NEW class of hydroperoxides derived from gum rosin is capable of production by a process described in a recently issued United States patent, No. 2,653,922, entitled, "Hydroperoxy-Substituted Rosin Materials and a Method for Their Production," issued to F. L. McKennon and R. V. Lawrence, and assigned to the Secretary of Agriculture. Developed in line with a policy to expand the uses of rosin and following closely a similar discovery for production of peroxides from gum turpentine,[1] the new process is available for use without payment of royalty.

Members of the Naval Stores Research Station at Olustee, Fla., formed the new products by oxidizing esters of hydrogenated or disproportionated rosin. The hydroperoxides thus produced have possible uses as catalysts in the manufacture of synthetic rubber, or as intermediates in the preparation of certain products which contain the rosin nucleus. One peroxide, prepared by oxidation of the hydrogenated methyl ester of rosin, has shown promise as a catlyst in cold rubber production, having reportedly led to improvements in some properties of the rubber.

[1] See our Feb., 1954, issue, p. 632.

No Hyatt Award

(Continued from page 782)

Industry, Inc. Established by Hercules in 1941 to honor John Wesley Hyatt, the award consists of a gold medal and $1,000, which have been presented annually to that individual who, in the judgment of the committee, has made an outstanding contribution to the development and advancement of plastics.

The growth and diversification of the plastics industry have made it increasingly difficult for the judges to select a single individual to cite for outstanding service during the year, Mr. Cruse explained. As a result of these industry changes, the terms, conditions, and plans of the Award are now being reappraised.

Cellulose Acetate for Vacuum Forming

A SPECIAL formulation of cellulose acetate, S704, has been developed by Celanese Corp. of America, New York, N. Y., for use in the manufacture of vacuum formed packaging items, display signs, and similar products. Available in clear and colored stock, the new material is generally adaptable to small- as well as large-cavity forming processes. Its use in these capacities reportedly makes possible a reduction in section thickness (due to the rigidity of the acetate), use of a shorter cycle, and elimination of blush and webbing in the product.

NEWS of the MONTH

Summary of Washington Report and National News

The program of natural rubber research and development in South and Central America started in 1940 is threatened with curtailment on the eve of successful completion, by the Foreign Operations Administration's refusal to allot $300,000 for the research part of the program for fiscal 1954.

The majority opinion of the Randall Commission on Foreign Economic Policy is opposed to international commodity agreements and buffer stocks in order to stabilize the price of natural rubber.

The amount of GR-S and Butyl rubber used in defense orders in 1951, 1952, and 1953 (½-year) has been made public by the Renegotiation Board in connection with the amount of renegotiation (about 10%) required of chemical suppliers to the synthetic rubber industry.

Tire manufacturers and dealers have joined forces to work out a program to support an effort to improve highways, promote traffic safety, etc.

Rep. Paul Shafer of Michigan has stated that natural rubber producing countries must realize that there is a limit to the extent that the United States can go in aiding the economies of these countries without impairing our own economy. With the demand for natural rubber to increase in the years ahead, he asked that the producing countries put forth every effort to improve the quality of their rubber institute replanting programs.

A good year with possible higher dividend payments by companies in the rubber industry was predicted for 1954 by Standard & Poor's.

Washington Report by Arthur J. Kraft

Curtailment of Government's South and Central America Rubber Program Threatened

This country's 14-year old program to aid Latin America to develop a natural rubber industry[1] is threatened with severe curtailment as a result of a decision of the Foreign Operations Administration to withdraw its support of the research program carried on by United States Agriculture Department scientists in cooperation with nine Latin American governments.

The threat became known last month, when the Commerce Department's Business and Defense Services Administration spearheaded an effort to work out a solution looking toward maintaining this USDA combined research and development program. At a meeting here February 11, rubber industry officials and representatives of the Office of Defense Mobilization, the Agriculture Department, FOA, and BDSA exchanged views on how to continue the research program through the coming year.

The meeting was called by and presided over by Everett G. Holt, assistant director, Chemical and Rubber Division, BDSA, after FOA let it be known that under its charter from Congress it could no longer see its way clear to picking up the tab of some $300,000 a year for rubber research in Latin America. FOA agreed, however, to continue making available another $300,000 for development (extension) work in connection with the program.

The industry representative at the meeting strongly supported the Agriculture Department's position that the two aspects of the program should be kept together and that research is necessary to support development work. For instance, it was pointed out that the ambitious wartime rubber plantation program of the Ford interests—the vast Amazon plantation—was wiped out by South American leaf blight and became a virtually total loss because the project was undertaken without adequate prior research into methods of coping with this disease.

The February 11 meeting apparently clearly established that FOA had taken a firm position against footing that part of the fiscal 1955 bill which would go for research work. Efforts to salvage that program were then turned to the possibility of the Agriculture Department going before Congress with a request for the $300,000 or thereabout which will be needed for the research segment of the program in the coming fiscal year. It appears that the Agriculture Department will put in a request for the necessary appropriation. Agriculture officials have been assured by rubber industry leaders of solid industry support for the appropriation and indications are that similar support will come from ODM and BDSA.

Purpose of the Program

Goal of the Latin American rubber program is the development of a blight-resistant, high-yielding tree as a prerequisite for establishment of commercial rubber plantings in this hemisphere. Aside from the economic benefits this would confer on Latin American countries, success in this endeavor would give the rubber consuming nations, including the U. S., assurance of a continued supply of natural rubber in the event that leaf blight disease reached the southeast Asian rubber area, causing widespread defoliation of that area's high-yielding rubber plantations. As of now, Asia's rubber trees, it is believed, could not survive an attack of leaf blight, or other serious leaf disease. Since the current research program is designed to develop a high-yielding, disease-resistant strain of rubber seedlings, its success could also be of substantial benefit to the Asian industry. Under the program there is close cooperation between the Rubber Research Institute of Malaya and the American-supported research stations in Latin America, born of their awareness that each has a stake in the succcess of the program and can mutually benefit from the knowledge developed through their respective programs.

The research and development program was instituted in 1940, with the U. S. and 14 Latin American countries participating. After the war, responsibility for continuing the program was assumed by the State Department, which received an appropriation for this work and turned the funds over to the Agriculture Department. In 1950, responsibility for the program was turned over to the Mutual Security Agency, precursor of FOA, as part of the Government's Technical Assistance program. At the present time nine Latin American countries are participating directly, although several others are serviced by Agriculture Department specialists from research stations located outside their borders.

In many cases the Latin American partners are making substantial contributions to the program, in grants of land, equipment, and other facilities and, in some cases, but generally to a minor degree, in money. FOA is reported to have adopted the position that, under its charter, it could supply funds for research only if these were matched by a pooling of funds contributed by the Latin American participants. The agency, however, has taken the view that it cannot consider non-monetary contributions, no matter how sizable, as meeting the test of a matching contribution. This view has been criticized as excessively narrow by industry men here, but FOA insists that its charter requires a matching financial contribution and does not permit it to consider alternative types of contributions by the Latin American participating governments.

Details of the Program

The program is administered by the Rubber Plant Investigation Section, Field Crops Research Branch, Agricultural Research Services, Department of Agriculture. Here's a rundown of what's being done under the program in eight of the nine countries:

Guatemala. On land leased at a token fee from the Guatemalan Government, the scientists are testing clonal material and the response of rubber trees to top-budding. Because of the protracted dry season on the eastern slopes, such trees can be grown without top-budding. On the Pacific slope, a small farm development program is in progress with a 150,000 acres planted with seedlings. Liaison is maintained with the Firestone research station in this country.

Costa Rica. The major research facility in the Western Hemisphere is located here, because environmental factors indicate that tree diseases prevalent in the hemisphere would be more severe in Costa Rica than

[1] India Rubber World, June, 1942, p. 239; July, 1942, p. 350; Aug., 1942, p. 461; Dec., 1942, p. 259; May, 1943, p. 143.

elsewhere, making it a good place for testing. All Western Hemisphere rubber seedlings and test materials are brought to this station for disease screening. Work at this station has shown promising results in curbing South American leaf blight, a disease which has never been found in the Caribbean area, but is rampant in Brazil. About three years ago, a new disease—phytophthora—never serious in the Asian rubber areas, came to the attention of the Costa Rica research scientists. This disease, also known as black stripe, ultimately attacks the tapping outlets of trees, reducing the flow of latex sap and causing serious loss.

BRAZIL. At the Institute of the North in Belem, U. S. Agriculture Department and Brazilian government technicians are working together in a program emphasizing developmental work. In the Bahia area, assistance is being given through the establishment of breeding gardens and other extension work to Brazilian smallholder planters interested in planting rubber trees. Spurred by the Brazilian Government, foreign rubber products manufacturers such as Firestone, Goodyear, and Pirelli are starting pilot plantations in this area—generally of some 1,000 acres, but likely to expand in time. Here the American scientists are aiding in supplying the types of seedlings best adapted to the soils and other environmental conditions. At Sao Paulo, in the south, similar aid is being given for pioneer planting, encouraged by the state government. Despite sometimes cold winters, indications are that rubber can be grown in this area.

MEXICO. Three U. S. technicians, working closely with the Mexican Government at a Mexican research station and a U. S. substation, are working toward encouraging development of a plantation industry adequate to make Mexico self-sufficient in rubber.

PANAMA. Here work has been under way on small breeding gardens, planted with a cross of Latin American disease-resistant materials and Far Eastern high-yielding clones.

BOLIVIA. Work here is primarily of a developmental, or extension service nature, with assistance being given to Bolivian planters.

PERU. Both research and development work are in progress. Scientists are studying various types of wild rubber brought out from the jungle and trying to adapt these jungle selections for plantation cultivation; U. S. scientists are aiding in selecting the types of jungle selections best suited to the area.

COLOMBIA. In cooperation with the Colombian Government, work is proceeding on the young government rubber plantation. In addition, exploration in the Amazon jungle for wild rubber is aimed at bringing out budwood for study for germ plasm lines at the Costa Rican research center.

Value of Research Program

The relatively new problem posed by the phytophthora disease has been brought under control at the Costa Rican research center, and part of this success story, according to scientists here, is due to the knowledge accumulated earlier through germ research on the South American leaf blight. This fact points up the value of the long and thorough study given to leaf blight in speeding solution to novel problems posed by newly discovered diseases. Development work is also proceedin~ in Costa Rica, where local planters are putting in rows of rubber trees, alternating with rows of food crops. The USDA scientists also are engaged in planting research on a pilot plantation scale, using a large area of land donated by the Costa Rican Government. Only 25 miles away similar experimentation is being conducted at the large plantation maintained by Goodyear. The two plantations are assisting each other through the exchange of information as well as material, with Goodyear supplying the U. S. Government plantation with Far Eastern clones (high-yielding) in exchange for disease-resistant material. According to USDA scientists, Goodyear, using Far Eastern clones alone, had to top trees twice and rebud in order to come up with trees that would withstand disease ravages. But, by planting the new disease-resistant clones supplied from the government plantation the company can now produce rubber at a cost comparable to that in the Far East.

While the U. S. assistance program has been well under way for at least a dozen years, scientists here contend that at least another three or four years will be needed before the job can be judged a substantial success. Thus far, they are very much encouraged by the prospects of solving the problems being tackled in the research program—chiefly the development of seedlings which can survive the diseases native to Latin America and still produce enough rubber to make such plantings commercially attractive. An adequate research program, they are convinced, is absolutely necessary before any large-scale commercial planting can be undertaken with reasonable assurance that it will not meet with such disaster as befell the ambitious—but abortive—Ford plantation venture. With this conviction, that developmental or extension work must have the support of solid research know-how, the American rubber industry is in full agreement.

The rubber industry officials who attended the February 11 meeting here were W. J. Sears, vice president, The Rubber Manufacturers Association; E. A. Stevens, treasurer, The B. F. Goodrich Co.; John McGavack, technical director, plantation division, United States Rubber Co.; B. H. Larabee, vice president, Firestone Tire & Rubber Co.; Charles H. Baker, chairman, Goodyear Footwear Corp.; Leland E. Spencer, assistant to president, Goodyear Tire & Rubber Co.; S. W. MacKenzie, director of purchases, U. S. Rubber; and Paul Wagner, rubber purchasing department, Goodrich.

Randall Commission against Buffer Stocks for Rubber

The President's Commission on Foreign Economic Policy advised Congress in late January that international commodity agreements and buffer stocks are not the answer to the problem of price instability for raw materials such as natural rubber.

This view had the support of at least nine of the 15 members of the Commission, which had labored for several months to draft a foreign economic policy to guide both Congress and the Administration. The Commission, headed by Clarence B. Randall, president of Inland Steel Co., Chicago, included five members appointed by the President, five Senators, and five members of the House of Representatives.

Commission's Majority Report

In that section of the bulky report dealing with the "Instability of Raw Materials Prices," a majority of the Randall Commission had this to say:

"Fluctuations in prices have particularly serious effects upon countries whose economies depend predominantly upon production and export of primary products. Extreme fluctuations not only induce distortions in the economic development of these countries; they sometimes shock their economies to an extent that throws great strain upon their social and political fabrics. . . . Greater stability of prices is one of the prime desires in the raw materials exporting countries; and, of course, it is desired too in the industrialized countries which import raw materials.

"Prices inevitably fluctuate with variations in supply and demand; and such variations are affected by changes in the general economy. In particular, the demand for primary products in international trade is affected by business conditions in the industrialized countries which import them. Because of its sheer economic weight, the American economy exercises a particularly great influence on raw materials prices.

"Proposals have been made to solve the problem of price instability by intergovernmental commodity agreements, involving export quotas, import quotas, price limits, reserve stocks, price stabilization purchases and sales (buffer stocks), production controls, or some combination of such devices. *The Commission does not believe that extensive resort to commodity agreements will solve the problem of price instability; and it believes that such agreements introduce rigidities and restraints that impair the elasticity of economic adjustment and the freedom of individual initiatives, which are fundamental to economic progress.* Moreover, the types of intergovernmental commodity agreements thus far tried or proposed for the purpose of stabilizing prices involve commitments which could lead, if extensively employed, to very great outlays of United States Government funds in certain contingencies, of indeterminable amounts." [Italics are those of the Commission—EDITOR.]

The Commission recommended the following "constructive contributions that the U. S. Government can make toward greater stability of world prices: (1) measures tending to relax or remove impediments to U. S. foreign trade and to encourage other countries to move in the same direction; (2) a policy of encouragement of diversification of the economies of the countries now excessively dependent upon a small number of products, and of encouragement of the governments of those countries to pursue policies likely to attract foreign investors to participate in the works of diversification; (3) avoidance of actions incidental to our own commodity control and stockpile programs that would have avoidably disruptive effects upon world prices; (4) continued consultation and cooperation with other nations to improve the knowledge of world supply and demand for materials and foodstuffs, and to explore possible means of lessening instability; and (5) policies which will temper the fluctuations of our domestic economy, which exert great influence upon the course of world prices."

Minority Comments

Dissenting from the majority's comments on commodity agreements and buffer stocks were John Hay Whitney, New York industrialist; David J. McDonald, president of the CIO Steel Workers Union; Senators Eugene D. Milliken (Rep., Col.) and Walter F. George (Dem., Ga.), and Representatives Daniel A. Reed (Rep., N. Y.) and Richard Simpson (Rep., Pa.). Of these, only Mr. Whitney and Mr. McDonald offered separate statements.

In his dissenting statement, Mr. Whitney declared:

"While recognizing the dangers inherent in international commodity agreements which provide for fixed prices and production and marketing controls, I believe that agreements which embody flexible price policies and which take into account long-term trends in world demand and supply may provide a means of protecting both producers and consumers from drastic movements in prices."

Mr. McDonald, in his somewhat longer dissent, declared, in part:

"The majority discussion of instability in raw material prices greatly oversimplifies the problems that arise from such instability and does not recognize some of the measures which can appropriately be taken to ameliorate these problems. The real reason why countries have supported the international stabilization of raw material prices has been the desire to stabilize the income of the people in their economies who live by the sale of the raw materials. There is in many countries a close relation between economic stability and political stability. *Areas like Indonesia and the Malay States, whose economies depend heavily on exports of raw materials to world markets, need greater economic stability if they are to be politically strong members of the free world.* [Italics supplied—EDITOR.]

"The measures suggested in the majority statement for dealing with the problem of instability in raw materials are useful and constructive, but may not be adequate. In addition to these measures, *the United States Government may find it appropriate to join in carefully negotiated international agreements which have as their purpose the reduction of fluctuations in the incomes of raw material producers. While minimizing restrictions which impede production, such agreements might embody flexible price policies which would take into account long-term trends in world demand and supply while at the same time protecting both producers and consumers from drastic movements in prices in response to temporary and reversible forces.*" [Italics supplied—EDITOR.]

Buffer Stock Scheme at IRSG Again?

It will be recalled that the International Rubber Study Group last year undertook serious study of the advisability of adopting a "buffer stock" scheme for natural rubber in order to assure price stability and guard against serious shortages of rubber. The proposal, however, failed to meet with majority approval of members of the IRSG and at this juncture may be regarded as dormant, if not dead. Nevertheless it is apparent that the natural rubber producing countries, particularly Indonesia and perhaps Malaya, may again raise the issue of working toward some type of international commodity stabilization agreement for rubber at the forthcoming IRSG meeting to be held in Columbo, Ceylon, this May.

The Government's Renegotiation Board made public in February in a staff bulletin detailed figures showing the amount of GR-S and Butyl synthetic rubbers used in manufacturing products for defense procurement over a 30-month period running through the first half of 1953.

The Board had published an amendment to its regulation 1453.5 under which contracts with RFC for materials and services to be used in the manufacture and sale of synthetic rubber are exempt from renegotiation under section 106(a) (6) of the Renegotiation Act of 1951, to the extent that such materials or services are required for the manufacture of synthetic rubber for sale thereof to a private person or private persons for non-defense use.

As explained in a previous article,[3] some 15 or 20 suppliers of chemicals and other materials used in the government synthetic rubber program will benefit by this amendment. Their sales to RFC will not be subject to 100% renegotiation. About 90% of the sales of these materials used for making GR-S and about 92.2% of the sales of these materials used for making Butyl will be exempt, because about this percentage of these synthetic rubbers was sold to rubber products manufacturers for conversion into tires and other products for the civilian economy.

The detailed figures were supplied to the Renegotiation Board by the Rubber Branch, Business and Defense Services Administration, Department of Commerce. The figures, in long tons, appear in the table which is printed at the bottom of this page.

Synthetic Rubber Consumption Dropping

Sales of synthetic rubber appear headed for a slight drop in the coming quarter—the three months of April, May, and June, according to early estimates prepared by Reconstruction Finance Corp. An official said that indications available at this writing are that the quarter's sales of GR-S will be slightly below the 126,700 tons or so estimated for the previous (January through March) quarter.

If this point proves true, it would appear that the estimate of fiscal 1954 sales presented in the President's budget message to Congress in late January will not be met.[2] That estimate was for a production of 608,900 long tons of both GR-S and Butyl in the 12-month period ending June 30, 1954.

Consumption (for the last two months RFC scheduled production figures, which are roughly equivalent, are used) of GR-S amounted to 391,260 tons for the nine-month period running from last July 1 through March 31, 1954. Butyl amounted to 42,706 tons for the eight-month period running from last July 1 through February 28 (the February figure again is scheduled production, rather than actual reported sales). Protecting these figures on an annual basis gives a GR-S total of some 521,000 tons and a Butyl total of some 64,000 tons, together a grand total of about 585,000 tons, or some 24,000 tons shy of the estimate prepared in December by RFC for presentation as part of the President's late January budget. If, as now expected, the last quarter of this year shows a decline, the gap will be even greater than the indicated 24,000 tons, but probably not much greater.

Monthly reports of industrial consumption will bear watching, since the RFC estimates—that given for the full fiscal year and the lower more current figures—are based partly on estimates supplied to the agency by larger consumers. Industry reports over the coming months will show whether consumption of new rubber is falling off or whether the prospective decline in synthetic purchases is being offset by larger purchases of natural rubber.

RFC has scheduled March production of GR-S at 42,640 long tons, including the oil content of masterbatch types. February scheduled output was 40,250 tons for GR-S and 4,950 tons for GR-I. At this writing the March schedule—tentative as it was—included no breakdown by various major types of polymers, nor did it include a figure for GR-I.

February's schedule included 27,100 tons of LTP GR-S, net plus oil basis; 6,400 tons of black masterbatch (gross weight); 10,000 tons of oil masterbatch (gross weight); 2,000 tons of oil-black masterbatch (gross weight); and 3,650 tons of GR-S latex. Actual sales for January totaled 43,874 tons of GR-S, net plus oil, including 30,579 tons of LTP GR-S. Sales of GR-I for the month amounted to 5,121 tons. A breakdown of January GR-S sales, on the same basis as given above for February production figures, shows 6,837 tons of black masterbatch; 11,819 tons of oil masterbatch; 2,081 tons of oil-black masterbatch; and 3,674 tons of latex.

Disposal Commissioners Visit GR-S Plants

The Rubber Producing Facilities Disposal Commission visited 19 government synthetic rubber plants on a tour of inspection covering several thousand miles and eight days last month. The three Commissioners—Chairman Holman D. Pettibone, Vice Chairman Leslie R. Rounds, and Everett R. Cook—were accompanied on the tour by Eugene Holland, executive director of the Commission; E. Dorrance Kelly, Director of the Office of Synthetic Rubber, RFC; and Don Hogate, special consultant to the Commission on public and legislative relations.

The itinerary of the tour follows: February 8, three plants at Baton Rouge, La.; February 9, two plants at Lake Charles, La.; February 10, three plants at Port Neches, Tex.; February 11, three plants at Baytown, Tex.; February 12, two plants at Houston, Tex.; February 13, two plants at Borger, Tex.; and February 15, four plants in the Los Angeles, Calif., area.

Other plants to be visited later included two at Akron, O., two at Louisville, Ky., one at Kobuta, Pa., one at Institute, W. Va., and two plants at Naugatuck, Conn.

Before departing on the tour, the Commission said that "a keen, competitive interest exists among prospective bidders so far interviewed." Talks with executives of companies interested in bidding for one or more of the facilities "have been chiefly exploratory in character," the Commission said, and "are maintained on a confidential basis." The companies which have held these discussions with the Commission include rubber, petroleum, and chemical companies, "some of them now operating plants" in the program, and "others who are not now engaged in the synthetic rubber industry," the Disposal Commission declared.

1951-1953 GR-S and Butyl Defense Order Percentages Given

	GR-S Consumption			Butyl Consumption		
	Total	Defense Orders	D. O. %	Total	Defense Orders	D. O. %
1951	625,169	71,124	11.4	70,500	6,246	8.9
1952	666,420	63,727	9.6	71,229	5,982	8.4
1953 (½ yr.)	354,208	30,499	8.6	44,839	2,289	5.1
Total for 2½ yrs.	1,645,797	165,350	10.0%	186,568	14,517	7.8%

[2] *Ibid.*, Feb., 1954, p. 636.

[3] *Ibid.*, Jan., 1954, p. 506.

Tire Manufacturers and Dealers Join in Highway Safety Conference

Tire manufacturers and dealers joined forces in Akron in late January to work out a program for actively supporting an effort to improve the nation's highways, promote traffic safety and adequate parking facilities for motorists.

Fifteen tire manufacturers and a like number of tire dealer representatives attended the day-long meeting, arranged by the Inter-Industry Highway Safety Committee, with headquarters in Washington, D. C. The I-IHSC is sponsored by tire manufacturers, the National Association of Independent Tire Dealers, automobile manufacturers, and the National Automobile Dealers Association.

The Akron meeting is to be followed by another early in March to select permanent chairmen and committee members for the tire manufacturer-dealer state committees. March 15 was set as the tentative deadline for announcement of state tire dealer highway and safety committee selections.

The entire effort of the tire manufacturer-dealer committees will be pointed for the month of May when automobile and tire dealers will plan for a month-long highway safety campaign. At the Akron meeting it was agreed that the slogan, "Check Tires—Check Accidents," would be used by tire dealers in the safety campaign, and several promotion pieces were outlined and agreed to for tire dealer use.

The aim of the program is for active campaigning at the state and local level for greater highway safety throughout the year. At the Akron meeting, H. D. Tompkins, Firestone vice president, and J. A. Hoban, Goodrich vice president, pointed out that the nation's motorists are driving less each year because of inadequate highways and the danger of accidents.

Mr. Tompkins declared, "Not only do we owe it to the motorist to take an active interest in highway safety and better roads, but frankly, it is a necessary step in insuring the continued good faith of the industry."

Speaking for the tire dealers, NAITD's President Tom P. McDermott declared that it is "absolutely inexcusable that the industry should wait any longer to get behind a program of highway safety. We owe it to our customers to engage in a program designed to cut down the alarmingly high accident and death rate on our roads and to insure more adequate highway and parking facilities for our people."

According to some figures, last year saw a drop of 10% in motor travel.

Those attending the Akron meeting were: manufacturer representatives—M. F. O'Neil and H. D. Tompkins, Firestone; J. C. Ray, U. S. Rubber; Pierre Maluski, Michelin; A. G. P. Segur, Lee; J. A. Hoban, M. G. Huntington, and C. T. Morledge, Goodrich; Victor Holt, Goodyear; R. W. Richardson, Kelly-Springfield; W. D. Cline, Cooper; Irving Eisbrouch, Dayton; John C. Ink, General; L. M. Seiberling, Seiberling; and George Flint, RMA.

Tire dealer representatives were—Tom P. McDermott, Ed Campion, Joseph A Abel, Ed Robertson, William Dean, Abraham Goldstein, J. Earl Stowe, Benjamin Wilbanks, Gerald P. Murphy, T. W. McCracken, Ray Grimshaw, W. J. Murphy, V. I. Whitney, Joseph A. Tacconelli, and Ashby Leeth, all listed as NAITD members.

Others attending were M. R. Darlington and Frank Lowrey, of I-IHSC, and W. W. Marsh and Philip Robinson, of NAITD's staff.

NAITD 1954 Tire Sales Forecasts

The National Association of Independent Tire Dealers forecasts 1954 replacement tire sales at 48.5 million units, or 2.5 million more than in 1953.

The estimate for this year is based, NAITD said, "on the fact that less new cars will be sold in 1954, which means a larger replacement market on cars two years or older. Automobile registrations as of December 31, 1953, stood at 46,146,343," making for a unit sale figure of 1.05 tires per car in 1954, about the same as in 1953, and a shade under the 1952 sales of 1.07 tires per car.

NAITD also put the market for replacement truck tires at 9,980,000 units for 1954, as compared with the 1953 figure of 9,480,000. Truck registrations totaled 9,215,000 at the end of 1953. Figured unit-wise, this means a replacement truck tire sale this year averaging 1.08 tires per vehicle.

The dealers' group also forecast a spurt in recapping this year, provided that dealers "bend every effort" to promote recapping.

National News

Rep. Shafer Says Further U. S. Help on Natural Rubber Price Not Practical; Reveals RFC Advance Synthetic Schedule

Rep. Paul Shafer of Michigan, in a talk at the annual dinner of the Rubber Trade Association of New York on February 23, emphasized that the natural rubber producing countries must realize that there is a limit to the extent that the United States can go in aiding the economies of these countries without impairing our own economy.

At the May, 1953, meeting of the International Rubber Study Group in Copenhagen, Denmark, Congressman Shafer said he was surprised and disturbed to find that the rubber producing countries still consider our government owned synthetic rubber industry as the greatest deterrent to a healthy and stable natural rubber economy. These countries also feel that our synthetic rubber operations are conducted under a cloak of secrecy, and this thinking should be dispelled, the speaker added.

The several steps taken by the United States in response to complaints from natural rubber producers in requiring consumers to order three months in advance, removing the mandatory ceiling on consumption of synthetic rubber, and making certain revisions in our natural rubber stockpile rotation procedures, have not been successful since the price of natural rubber has since decreased instead of increased.

These steps which have been taken should certainly indicate a willingness on the part of the United States, however, to remove barriers that have been some of the grounds for charges that our government seeks to control natural rubber prices, it was pointed out.

The establishment of a reasonable, stable price for natural rubber would contribute far more to the strained economies of the Far East than any form of economic aid which may be devised and also at far less cost to our government. Natural rubber producing countries must realize, however, that there is a limit to which we can go. We have already invested tremendous sums of money in a security stockpile of natural rubber, and other consuming countries would do well to follow our example.

Producing countries should also put forth every effort to improve the quality of natural rubber and within the limits of their financial ability institute replanting programs. The demand for natural rubber is not going to diminish in the years ahead. It will increase—as will the demand for all new rubber, Rep. Shafer said.

New RFC Policy

The new policy of RFC to make public, each month, its synthetic rubber production schedule and its estimated forward sales of synthetic rubber for the ensuing quarter was revealed by Shafer simultaneously with the RFC in Washington. The following table, which covers the first five months of 1954, includes the oil used in oil-extended rubbers, but excludes the carbon black used in carbon black masterbatches:

GR-S Type Synthetic Rubber
Long Tons (Net Plus Oil)

	Jan.	Feb.	Mar.	Apr.	May
Production*	43,426	40,250	42,640	37,250	39,000
Sales*	43,700	37,000	37,500	38,500	37,000

*Preliminary estimate.

A production of 37,000 tons was also estimated for June, but no estimate of sales for that month was available. The inventory of GR-S in the hands of the government on January 31, 1954, was given as 80,289 tons.

In commenting on synthetic rubber plant disposal legislation, Shafer said that although the 1953 law was not entirely to his liking, since the appointment of Disposal Commissioners Pettibone, Cook, and Rounds, he was quite hopeful that a program to sell the plants in early 1955 would be accomplished. He urged that companies submit at any time draft proposals in as complete detail as possible, setting out all currently available ideas, but excluding the dollar amount proposed to be offered. In the Disposal Commission's opinion, this procedure would be mutually beneficial in the case of all prospective purchasers, since it would afford opportunity for necessary discussions of technical details and conditions prior to the submission of definitive proposals.

New RTA Officers

Officers and directors of tht RTA of New York for 1954 follow: chairman, A. L. Grant, Chas. T. Wilson Co.; vice chairman, S. G. French, H. W. French & Co.; president, R. D. Young; treasurer, Philip Billhardt, B. Billhardt; and, secretary, A. J. Garry. The directors are R. A. Badenhop, Robert Badenhop Corp.; Mr. Billhardt; J. S. Cornell, South Asia Corp.;

Mr. French; Mr. Grant; F. J. Jackson, Hecht, Levis & Kahn; S. J. Pike, Sid Pike & Co.; F. S. Rutter, M. Golodta & Co.; and H. Weinstein, Paul Elbogen & Co.

Good Year with Possible Higher Dividends Predicted

In the issue of its "Industry Surveys—Tire and Rubber," dated February 4, Standard & Poor's, New York statistical firm, predicted that the rubber goods fabricating industry should have a good year in 1954, and that some gains in earnings are looked for. Dividends, which have continued conservative in relation to earnings in the industry, may be somewhat larger in 1954 than in 1953.

The decline in tire shipments indicated for 1954 should be moderate, predicated on projected lower motor vehicle production and smaller military requirements on one hand, and on larger replacement volume on the other. Tire inventories at the end of November, 1953, approximated 14,851,000 units, under the peak figure of 16,973,000 at the end of May, but higher than the 12,272,000 inventory of November, 1952.

With several months of the seasonally slow selling period ahead, these inventories mean a highly competitive market for tire sales, it was explained. A comparison with prewar tire inventories suggests, however, that after making allowance for the present high sales base, the situation should not prove oppressive.

Deliveries of special defense items and industrial lines this year are also expected to fall short of the 1953 experience, as a result of the stretch-out in the arms program. Further growth is expected, however, in such non-tire lines as foam rubber and chemicals. Balancing all factors, total sales are expected to run at an excellent rate measured by all but exceptional 1952-1953 standards, it was said.

The contraction in 1954 pretax earnings will be more severe than that in sales, but, in many cases, important benefits are being realized in relief from excess profit taxes as of December 31, 1953. Thus some gains in final earnings are looked for, and where declines occur, they should not be of serious proportions according to Standard & Poor's.

General Tire Talks Merger with Plastics Firms

In connection with its annual report, issued in mid-February, The General Tire & Rubber Co. announced that its management is considering asking the stockholders to approve, at their annual meeting on April 6, the merging into General Tire of Textileather Corp. and Bolta Co. The combined sales of these two film and sheeting fabricators were indicated as in excess of $40 million annually.

With completion of its new $6 million polyvinyl chloride resin plant in Ashtabula, O., in midyear, General Tire points out that it could reduce the raw material cost for these two film and sheeting plants and almost assure a profit, because the plants have been able to make a profit paying a higher cost for their raw material.

It was also pointed out that General Tire sold its stock in the Mansfield Tire & Rubber Co. in order to provide a substantial part of the financing for the Ashtabula resin plant, and that the mergers with Textileather and Bolta, if approved, would complete the vertical integration of General's plastics interests. The resin from Ashtabula will be used not only by the Textileather and Bolta plants, but also by the existing General plants at Jeannette, Pa., and Marion, Ind., for film and sheeting for the automotive, upholstery, luggage, and household industries.

General Tire finds the outlook for tire sales encouraging for 1954 and expects its industrial products division, meeting the needs of automotive, aircraft, household and electrical appliance, farm machinery, communication industries, and the military, to continue its sales gain in 1954.

Other Industry News

Neoprene Sales Up 15%

The past year saw recorded an all-time high in the consumption of neoprene synthetic rubber, product of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., with an increase of more than 15% over the amount used in 1952. In addition, the year's closing found a sufficient quantity of the elastomer on hand to accommodate two months' demand, marking the first extensive period in the history of the product when production maintained a comfortable margin over industry's requirements.

Confidence in a generally favorable growth for neoprene in 1954 was demonstrated by the company by recently announced plans to build a new plant at Montague, Mich.

Gains over the past year were sharpest in the automotive field, with significant increases also realized in the use of neoprene for soling, industrial belting, protective linings and coatings, tires, and coated fabrics. Contributing also to the sales increase was the expansion of industrial utilities, due to the wide use of neoprene as jacketing on wire and cable.

Buys Glass Fiber Facility

Pittsburgh Plate Glass Co., Pittsburgh, Pa., has purchased the glass fiber manufacturing facilities and other assets of the Glasfloss Division of Tilo Roofing Co., Inc. These Glasfloss assets include the manufacturing plant at Hicksville, N. Y., as well as machinery and other equipment for glass fiber production, inventories, patent rights, trade marks, and good will. The purchase price was not announced.

Shell's Department Changes

A series of appointments in the manufacturing department of Shell Chemical Corp., 50 W. 50th St., New York 20, N. Y., was announced last month. All of the appointees have long been associated with the company.

Martin Buck, manager of manufacturing engineering, has been made assistant to the vice president in charge of manufacturing.

E. S. Robb, assistant manager of manufacturing engineering, has replaced Mr. Buck as manager of that department.

R. L. Kittle, superintendent of the company's Houston, Tex., plant, was promoted to manager of the manufacturing operations department.

M. R. Sprinkle, plant superintendent at Denver, Colo., has been named manager of the manufacturing development department.

Glenn Purcell, manager of the plant at Dominguez, Calif., has become manager of the Houston plant, succeeding E. M. Downey, now manager of manufacturing.

E. W. Casagrande, superintendent of the Pittsburg, Calif., plant, has been appointed manager of the Martinez, Calif., facility, to succeed F. E. Caddy, now manager of the company's new plant at Norco, La.

Buck, Robb, Kittle, Sprinkle, and Downey will assume their new duties at the head office of Shell Chemical in New York.

Makes Molded Foam Products

Production of small-size molded foam rubber articles has been initiated by Creative Foam Rubber Corp., New York, N. Y., after a period of pilot-plant operation for the past eight months.

Synvar Stock Purchased

The purchase of a substantial portion of stock in Synvar Corp. and Synvar Southern Corp., Wilmington, Del., by Delaware Chemicals, Inc., Staten Island, N. Y., and Wilmington, was announced during the past month.

Although no changes in the existing personnel staff of Synvar are contemplated at present, plans to merge Delaware and its three associated companies with the Synvar organizations are being studied.

Delaware recently completed a $150,000 expansion of its Staten Island facility, but construction of a new plant in northern New Jersey, authorized early last year and expected to cost $1,000,000, has been delayed until plans for the new combination have been better coordinated.

Synvar is a manufacturer of urea resins, phenolic resins, and phenolic molding compounds. Delaware is a producer of chemicals for the paint, varnish, and lacquer industries.

New Development Division

American Hard Rubber Co., 93 Worth St., New York 13, N. Y., has announced the establishment of a development division and the appointment of William M. Bergin to head the new organization. Purpose of the department will be to originate and facilitate the development of new and old products and materials.

Mr. Bergin, formerly chief engineer of the Kaylo Division of Owens-Illinois Glass Co., will be responsible in his new position for integrating the functions of research, engineering, and product development.

Steel Wire in Retreads

A new retreading process for molding heavy-duty steel wire into the tread contact area of truck tires has been developed by The Firestone Tire & Rubber Co., Akron, O. The wire-equipped treads, called Dura-Trac, will reportedly provide greater traction and improved protection against road failure.

The process consists of looping the wire into the matrix rib of the mold and butting it; next the tire is placed into the mold and cured in the normal manner. The tread rubber, when heat and pressure are applied in the mold, flows around the wire and "sets" it permanently into the tread stock. The wire, a heavy-gage steel alloy designed in a zigzag pattern, can be used in any rib-design truck tire without altering or changing the design in any way.

It is claimed that while the tire is rolling free, the tread rib is relaxed, and the wire points do not contact the surface of the road. In stopping, however, or when the vehicle is accelerating or skidding, the tread rubber stretches, and the steel wire claws, numbering in the hundreds per rib foot of tread, grip the road to increase the tire's traction. It is further believed that the presence of the wire coils in the ribs will prevent failure of the tire from nails, glass, and other foreign matter of this type.

Neville Advances Two

E. Glenn Isenberg has been appointed sales manager and R. M. Lauderbaugh has been promoted to advertising manager of Neville Chemical Co., Pittsburgh, Pa. Mr. Isenberg, a member of the company since 1936, had been assistant sales manager until this change.

Mr. Lauderbaugh, with 13 years of service with Neville, will continue to act as export sales manager in addition to his new duties.

New Vinyl Film Width

The availability of Ultron vinyl film, product of Monsanto Chemical Co., Springfield, Mass., in widths of 72 inches has been announced by the company. The material was formerly available in widths up to 54 inches only. Major advantage of the new size is the elimination of seams which mar the beauty and raise the fabrication cost of products.

Columbian Carbon Plant in La.

Plans to construct a new oil process carbon black plant with an ultimate annual capacity of 60,000,000 pounds, in St. Mary's Parish, near North Bend, La., have been announced by Columbian Carbon Co., 380 Madison Ave., New York 17, N. Y. The project is expected to begin immediately, with operation of the first unit set for November. Total cost of the program is estimated at $3,000,000.

Statex 125, a super abrasion furnace black, will be among the products of the new plant. Natural gas from nearby fields and liquid petroleum products from Gulf Coast refineries will be the basic raw materials used to produce materials which will be used principally by the rubber industry.

Sales agent for distributing Columbian carbon black, including that to be produced in the new plant, is Binney & Smith, Inc.

Stauffer's Louisville Plant Now in Operation

Stauffer Chemical Co. has started operations at its new $3,500,000 plant in Louisville, Ky., according to Hans Stauffer, executive vice president.

The plant, located on a 90-acre tract one mile outside the city limits, with Ohio River frontage, was built for the production of perchlorethylene, carbon tetrachloride, and hydrogen chloride in tankcar quantities. Stauffer owns an adjoining 90 acres of land for expansion, which is expected within two years.

Basic raw materials for production will be hydrocarbon products. Stauffer will supply hydrogen chloride to local consumers and will distribute perchlorethylene and carbon tetrachloride to consuming centers.

An important feature of the manufacturing process is that provisions have been made for plant operation without the release of noxious gases into the atmosphere.

H. L. McLean, formerly manager of Stauffer's Niagara Falls, N. Y., plant, is now manager of the new facilities, where the staff will consist of 50 men. Before joining Stauffer, Mr. McLean had been a superintendent for Westvaco Chemical Division, Food Machinery & Chemical Corp.

Moves New York Offices

Stauffer Chemical Co. has moved its New York headquarters from 420 Lexington Ave. to 380 Madison Ave., New York 17, N. Y.

New Facilities of Stauffer Chemical Co. in Louisville, Ky.

Bancroft W. Henderson

Cyanamid Reorganization

The organic chemicals division of the American Cyanamid Co., Bound Brook, N. J., has been formed to embrace the development, production, and sales of the products of the former dyestuff, textile resin, intermediate and rubber chemicals, and explosives departments of the Calco Chemical Division, and the petrochemicals division of American Cyanamid. This reorganization follows a recently announced change in the divisional structure of the company.

It was also announced that Bancroft W. Henderson has been named director of sales of the organic chemicals division. Mr. Henderson had been manager of the intermediate and rubber chemicals department of Calco since 1935, before which he was manager of the crude rubber department of the company. He is a member of the American Chemical Society, the Society of Chemical Industry (Great Britain), and various social clubs and organizations.

Promoted by Dunlop

The election of Lawrence D. Hartford and Robert C. Mackenzie to the posts of sales vice presidents of Dunlop Tire & Rubber Corp., Buffalo, N. Y., has been announced.

Mr. Hartford has been with the company since 1923, having held the posts of office manager of the Chicago division, sales manager of the Kansas City, Chicago, and Buffalo divisions, and tire sales manager (since 1936).

Mr. Mackenzie joined Dunlop in 1938, rising to the positions of credit manager of the Cleveland division in 1940, general credit manager in 1947, and assistant treasurer in 1948.

New Bolling Representative

Stewart Bolling & Co., Inc., 3190 E. 65th St., Cleveland 27, O., has appointed Francis S. Frost sales representative to serve the Chicago area. His headquarters are at the company's office at 30 N. LaSalle St., Chicago 2, Ill.

The company states that increased sales of its rubber and plastics equipment have made this intensified service necessary.

n

of the
Brook,
ce the
of the
extile
nicals,
Calco
hemi-
This
an-
struc-

ncroft
rector
divi-
nager
hemi-
5, be-
crude
. He
mical
ndus-
social

tford
posts
Tire
has

com-
posts
ision,
Chi-
sales

1938,
nager
gen-
stant

ve

65th
ancis
e the
t the
Chi-

sales
have
y.

Seiberling in South America

Plans to form a corporation by the Seiberling Rubber Co., Akron, O., and a group of Colombian investors for the construction of a new plant in that South American country and the manufacture and sale of Seiberling tires there were announced January 31.

Seiberling's partner in the venture will be Almacen Villegas, a firm which, after being consolidated into the new corporation, will continue to manufacture present lines of rubber flooring, shoes, camelback, and other rubber products. The new tire factory will be added to the existing facilities of the firm.

In this, the first full-scale overseas manufacturing venture of the Akron company, Seiberling will engineer and supervise construction of the new plant and will furnish machinery, molds, and specifications, and the use of its trade marks. Later Seiberling will train key personnel and will provide technical assistance and supervision, and sales aid to the new corporation.

Productos de Caucho Villegas, S. A., as the new corporation is to be known, will have its principal ownership in Colombian hands, with the American rubber company a minority owner. This arrangement is in line with governmental industrial policy of the South American republic. The new firm will be incorporated with a capitalization of about $2,800,000.

A booming automotive market in Colombia was given as the major reason for this move, and the country's policy of prohibiting import of tires in sizes made in Colombia should provide the new corporation with a great sales advantage. Seiberling will probably export tires of types not made there from its Akron plant in order to handle the demand that will result from increased Colombian distribution. Future arrangements to ship Colombian-made tires, to other South and Central American countries are being considered, since transportation savings would improve Seiberling's competitive position in that area.

Shell Advances Caddy

F. E. Caddy has been appointed plant manager of Shell Chemical Co.'s new facility at Norco, La. Mr. Caddy, formerly manager of the company's Martinez, Calif., plant, will have as assistant superintendent C. H. Plomteaux, of Shell's manufacturing operations department.

The Norco plant, now under construction, will produce allyl chloride and chlorohydrins, both of which will be used to increase the firm's glycerine output by more than 25,000,000 pounds a year. Quantities of Epon resins and epichlorohydrin will also be available as a result of this expansion.

RMP Incorporates in Pa.

Rare Metal Products Co., Atglen, Pa., supplier of golden and crimson antimony to the rubber industry, has incorporated under the laws of the Commonwealth of Pennsylvania and has acquired all the properties and assets of Rare Metal Products Co., a New Jersey corporation. The firm moved to Atglen in 1946.

Norman R. Wilson, formerly general manager of the company, has been elected president and general manager; while Vernon Kennel has been elected secretary-treasurer, a post he has held with the firm since 1946.

Kleinert Breakfast Host

The annual Notions Breakfast of I. B. Kleinert Rubber Co., New York, N. Y., held in conjunction with the National Notion & Novelty Show, attracted nearly 850 notions buyers and merchandise managers to the Hotel Astor on February 9.

Preceding a panel discussion on notions department problems, Ralph K. Guinzburg, president of Kleinert, spoke briefly on the feared economic recession in this country, stating that any such decline should not have too great an effect on notions sales. He also made public the advertising media that will be used to promote the company's products in the spring (such advertising will go in magazines that have a total circulation of almost 36,500,000); and he announced that the annual Notions Market Week will begin this year on August 16.

Members of the panel who gave short addresses on the various difficulties associated with notions departments in large stores were James Rotto, moderator, assistant vice president in charge of sales and publicity of The Hecht Co., Washington, D. C.; David Arons, sales promotion director of Gimbel Bros., Philadelphia, Pa.; Norris Hollingsworth, display director of Thalhimer's, Richmond, Va.; Les Marcus, main floor merchandise manager of J. L. Brandeis & Sons, Omaha, Neb.; Walter McTigue, merchandise manager of Carson, Pirie, Scott, Chicago, Ill.; and E. B. Weiss, director of merchandising of Grey Advertising Agency, Inc., New York.

Following Mr. Guinzburg was Richard M. Bleier, assistant to the president of the rubber company, who addressed the gathering on "A Budget for Staples."

A fashion show completed the occasion. Arranged for in collaboration with *Charm* magazine, the show had as its theme "Two Weeks with Pay" and featured fashions with notions as accessories.

Hawkins Promoted

International Shoe Co., St. Louis, Mo., has appointed M. L. Hawkins manager of the rubber manufacturing division. Formerly superintendent of the Hannibal, Mo., rubber plant of the company, Mr. Hawkins will now be responsible for manufacturing and product development of rubber and composition soling and heeling materials at International's two rubber facilities. He brings to this newly created position wide experience gained as a foreman, production manager, plant operations manager, and assistant superintendent before becoming superintendent of the rubber factory in 1949.

Picked to succeed Mr. Hawkins is R. H. Bowles, previously plant production superintendent at Hannibal. Mr. Bowles joined the company in 1928 and served as foreman in the rubber plant from 1929 to 1951, when he was made production superintendent.

T. L. Pilcher, who has served as personnel manager of the plant since 1945, has been promoted to assistant superintendent to replace J. R. Wheelan, recently appointed superintendent of the company's new rubber plant in Bryan, Tex.

Vulcanized Rubber & Plastics Co., Morrisville, Pa., has appointed Robert G. Werner general manager and David Lewis director of sales. Mr. Werner was assistant to the president for the past three years; while Mr. Lewis formerly was sales manager of Fruehauf Trailer Corp.

Employes to Stockholders

On February 1 more than 2,400 employes of The General Tire & Rubber Co., Akron, O., became stockholders in that company in accordance with a unique group stock purchase plan. By this means, domestic plant "employes who so desire may become the owners of common stock of the company," according to W. O'Neil, president of General.

The plan of group purchases in round amounts will provide a considerable savings in brokerage charges over what it would cost an individual to make "odd-lot" purchases himself. Purchases will be made in 100-share lots at the 100-share commission rate, which means that the net charge to an employe who buys General stock at $30 per share will be $0.30 rather than the $2.63 that it would cost for commission and "odd-lot" charges if he were to buy through the New York Stock Exchange. Another advantage of the plan from the monetary viewpoint is that the participant will accumulate stock at a moving average cost of continuing semi-monthly purchases rather than at one particular price, a procedure known as "dollar cost averaging."

So as not to cause any abnormal effect on the market for General's common stock, limitations have been placed on the amount of money that can be contributed to the plan. This amount cannot exceed 5% of the 1953 earnings of one employe and is limited to a collective sum of $50,000 per month for all participants. Any employe of the company or of its subsidiaries can participate by payroll deductions or direct payment to the plan's administrator, General's treasurer, T. S. Clark.

Termination date of the plan is January 31, 1959, although arrangements for a five-year extension will be possible before that date. The entire cost of the plan will be absorbed by The General Tire & Rubber Co.

Sales Changes at Carbide

Recent changes in the industrial chemicals sales organization of Carbide & Carbon Chemicals Co., 30 E. 42nd St., New York 17, N. Y., have been announced.

They include the appointment of R. M. Joslin, formerly central division sales manager, as assistant sales manager of industrial chemicals. Replacing Mr. Joslin is E. R. Young, who will supervise the sales division's activities from the company's Cleveland offices.

Made public at the same time was the appointment of W. M. Anderson to the post of manager of the Cleveland district sales office and of R. G. Metz as manager of the Indianapolis district sales office.

ARco Sales Office Opened

Announcement has been made of the opening of a sales office in Cleveland, O., by Automotive Rubber Co., Inc., Detroit, Mich., and of the appointment of B. C. Mulheran as head of the new office. The company, an organization that consults, engineers, fabricates, and installs corrosive-resistant equipment, recently obtained the services of Mr. Mulheran. The new Ohio manager is a veteran of 11 years of sales engineering experience in the corrosive-resistant materials field.

HERE'S EXPERIENCE THAT CAN HELP YOU WITH YOUR PROCESSING

When you need a process aid or have a problem involving one, it will pay you to take advantage of Sun's technical knowledge and experience in the field.

As early as 1937, working with leading rubber companies, Sun made commercially available a petroleum derivative remarkably suited for plasticizing Neoprenes, natural rubbers and reclaims. This was followed by a number of other process aids—among them Circosol-2XH, an elasticator that greatly improved the rebound properties of GR-S synthetics; and Sundex-53, a low-cost product highly compatible with natural rubbers, GR-S, reclaims, and various combinations of the three. Leadership in the field and knowledge of the industry's requirements brought about Sun's participation in the experimental work which led to the development of oil-extended synthetic rubbers.

Put this experience, plus a complete line of products, to work for you—in lowering costs, in improving product quality, in solving processing problems. For the assistance of Sun's rubber technologists, write SUN OIL COMPANY, Dept. RW-3.

INDUSTRIAL PRODUCTS DEPARTMENT
SUN OIL COMPANY

SUNOCO ®

PHILADELPHIA 3, PA. • SUN OIL COMPANY LTD., TORONTO & MONTREAL

Research Combine Proposed for Shoe Industry

A program calling for all shoe companies to contribute one-tenth of 1% of their net sales dollar to an organization which would conduct much needed research in the shoe industry was suggested to a group of manufacturers recently by H. W. Rollman, president of Ro-Search, Inc., and Wellco Shoe Co., Waynesville, N. C. Such a plan, to fall within the framework of a proposed Vertical Shoe Alliance, founded by Mr. Rollman, would provide a half-million-dollar research budget to finance work whose results would be available to the entire industry.

It was explained that such money that is currently being expended for research totals less than the proposed budget, and that the fruits of the work, since it is being undertaken by some of the big companies and one or two machinery manufacturers, sometimes help the small manufacturer and shoe dealer only years later. This program, if effected, is expected to eliminate this time lag to the benefit of the small companies in the shoe industry.

Wins Goodyear Safety Contest

Top honors in the Worldwide Safety Contest for 1953 of the Goodyear Tire & Rubber Co., Akron, O., went to the company's textile mills at Decatur, Ala., for achieving a record of 1,203,316 man-hours worked without a lost-time accident. The employes at the Alabama mill won the award in competition with some 71,000 other Goodyear workers who had registered more than 154,000,000 man-hours.

Airfoam Order

Arrangements for the purchase of 50,000 specially designed one-piece, reversible Airfoam cushions, said to be the largest single order for Airfoam ever made by a furniture manufacturer, have been completed. The Luxury Furniture Co., conducted the transaction for the Goodyear product through the rubber manufacturer's representative, Stephenson & Lawyer, Inc.

The result of improvements in processing, and in the shape and design of molds, these new cushions are produced on a large scale with a full-curved, smooth front. The product will be used in the company's complete line of upholstered furniture.

1,120-Pound Press Pad

A press pad, believed to be the world's largest fully molded rubber part, has been made by Goodyear's industrial products division. Weighing 1,120 pounds and measuring approximately five by 13 feet in area, the specially compounded pad is designed for installation on a direct-acting hydraulic press. The press is used to form huge aircraft parts at pressures up to 10,000 psi.

Timken in Mexico

Formation of Timken Roller Bearing De Mexico, a new company designed to handle the sale of products manufactured by The Timken Roller Bearing Co., Canton 6, O., has been announced. Both the sales offices and the warehouse facilities, the latter containing stocks of roller bearings and removable rock bits, are located in Mexico City. Manager of the new company is A. E. Porter, for several years the Timken representative in that country.

Thiokol-Lined Freon Hose Reduces Gas Loss

A highly flexible synthetic rubber hose, lined with Thiokol FA, has been developed by Quaker Rubber Corp., Philadelphia, Pa., for use in refrigeration units that employ Freon 12 gas. Major advantage of the new product, "Qua-Seal," is that the loss of refrigerant through permeation is practically negligible at temperatures from —40 to 200° F. and pressures up to 300 psi., according to the manufacturer.

In addition to its high flexibility in all directions, the "Qua-Seal" hose is claimed to attenuate sound under vibration. Tests reported by Quaker indicate that the diffusion rate through a $\frac{1}{2}$-inch diameter hose under a differential operating pressure of 260 psi. at 160° F. is 0.37-pound per year per foot. At 65 psi. and 70° F., this rate was reduced almost to zero.

This low loss rate is credited to the use of the Thiokol compound. Used as a heavy inner liner, the material also provides the necessary properties of thermal stability, solvent and oil resistance, and inertness to metal that are required for proper functioning of the product. Comparison of the "Qua-Seal" hose with one-wire braid MIL-H-5511 type of hydraulic hose lined with other synthetic oil-resistant polymers (both $\frac{1}{2}$-inch in diameter and subjected to 260 psi. at 160° F.) shows a loss of gas through the latter hose to be as much as 2,200% more than with the new product. Furthermore, couplings attached to the "Qua-Seal" lose the same amount of Freon 12 as couplings attached to the MIL-H-5511 hose.

A wide range of sizes, all of which are represented as having bursting pressures of 1,250 psi., is produced. Cost of the hose is reported to be much less than for comparable flexible metal hose. Especially successful results for use of the "Qua-Seal" in mobile refrigeration units in trucks have been realized, according to Quaker.

Israel Firm Declares Dividend

After only one year of operation, the Alliance Tire & Rubber Co., Hadera, Israel, has declared its first dividend, a return of 3% or $1.50 per share, over a six-month interim from April to September, 1953.

Arthur Taubman, president of the company, at a meeting in Chicago, Ill., on February 7 expressed justifiable pride in this achievement, pointing out that Alliance is an independent project not subsidized by United States foreign aid money or the Point Four (Technical Aid) Program. The company's stock is split equally between American and Israel citizens.

A progress report from the company described existing conditions at the plant from the labor program to sales successes. Production of tires has risen in the last six months from 2,000 to 6,000 a month, 85% of which is bus and truck tires. Consumer demands in the country are being met, and a substantial quantity of production is being exported to foreign countries.

Mr. Taubman credited much of the success of the new firm to Dayton Rubber Co., Dayton, O. Through a long-term contract as technical supervisor as part of Dayton's Foreign Technical Service, the American firm designed the Alliance factory, supervised installation of its American-made equipment, trained technical personnel at its Dayton plant, and instructed management on many accounting practices and other procedures. Dayton Rubber will continue to serve the Israeli firm under the terms of the present agreement.

Resistance Welding of Non-Ferrous Materials

A development program intended to broaden the scope of economical application of resistance spot, rollspot, and seam welding in the fabrication of non-ferrous components of aircraft and missiles has been authorized for Goodyear Aircraft Co., Akron, O., by the Air Materiel Command, Wright-Patterson Air Force Base, O. Batelle Memorial Institute, Columbus, O., is assisting in the program under subcontract to Goodyear.

The primary objective of the project, completion of which is set for 30 months hence, is to increase the production applications of this type of fabrication for both structural and non-structural magnesium and aluminum alloy assemblies in gages up to $\frac{1}{4}$-inch. The ultimate result of the program is expected to be the development and standardization of basic design criteria for spot and seam welding.

Rubber Springs in Buses

Torsilastic rubber springs by The B. F. Goodrich Co. are being used as the suspension system on some 740 new buses of the Chicago Transit Authority, and plans for increasing this number to 1,000 have been made. According to the manufacturer of these vehicles, Flexible Co., Loudonville, O., a total of 5,900 buses equipped with rubber springs instead of the conventional type of springs is being operated in this country.

Goodrich explains that the device consists of a metal shell and a central metal shaft, with the space between filled with rubber that is bonded to both metals. The required springing action occurs when a torque arm rotates either the shell or the shaft while the other is held stationary.

Evans in Europe

Ralph L. Evans, president of Evans Research & Development Corp., New York, N. Y., embarked last month for a four-month business trip to England and the Continent. Accompanied by Ralph L. Evans, Jr., manager of the foreign department of the company, Dr. Evans will visit manufacturing plants and laboratories affiliated with his organizations. He will take with him new technical ideas and information on products that may be valuable to European industry; outlet for such material is a planned expansion of the Evans' business interests there. At the same time Dr. Evans will investigate certain new technical developments in Europe which may be applicable to chemical industries in this country.

Changes at Athens Machine

The appointments of Albert J. Slatter as vice president and general manager and William M. Mapes as vice president in charge of sales for The Athens Machine Co., Athens, O., have been announced.

The recent expansion of the company that will eventually permit a 30% increase in the production of tire molds has been completed. Factory personnel is currently being trained in order that this potential increase can be realized.

Promotions at Monsanto

Seven persons in the sales department of the plastics division, Monsanto Chemical Co., Springfield, Mass., have been given new assignments, according to a recent release from the company.

Robert U. Haslanger, Chester L. Jones, and Ewdin L. Hobson have been appointed directors of sales for raw materials (including monomers and formalin), for coatings and adhesives, and for plastic products, respectively. These posts, newly created following a reorganization of the company, are under R. C. Evans, general manager of sales and director of marketing.

Named as assistant directors of sales were David S. Plumb, for Opalon resins and compounds; Theodore S. Lawton, for Vuepak sheets, Ultron film, Lustrex, and Resinox compounds; and Stanley L. King, for Saflex products.

At the same time, another newly created post, director of field operations for the division, has been filled by James P. Skehan, formerly district sales manager of the New York office.

Bamberger Elections

A. Bamberger Corp., 703 Bedford Ave., Brooklyn 6, N. Y., last month announced that its board of directors had elected Walter E. Hirtz executive vice president and Herbert H. Goldmark, Arthur L. Metzger, and Matthew T. Staszak vice presidents.

The same appointments have been made by the board of Bamberger's affiliate, American Molding Powder & Chemical Corp.

The Bamberger corporation reprocesses plastics scrap; while American Molding compounds virgin thermoplastic materials and manufactures Ampacet cellulose acetate and polystyrene.

Adds to Sales Staff

Rubber & Asbestos Corp., 225 Belleville, Ave., Bloomfield, N. J., recently named two new technical sales representatives, George B. Stanton, Jr., and Charles L. Stachel.

Mr. Stanton was formerly chief chemist of Arvey Corp., where he specialized in adhesives research and development work for the past five years.

Mr. Stachel for the past 11 years was with the adhesives development staff of the mechanical goods division of United States Rubber Co. and prior to that time had been with the adhesives division of Borden Co. Mr. Stachel's headquarters will be in Fort Wayne, Ind., in keeping with Rubber & Asbestos' expanded adhesives service program for midwestern industry.

Thiokol Advances Jorczak

J. W. Crosby, president of Thiokol Chemical Corp., Trenton, N. J., has announced that the board of directors, at its January 18 meeting at Longhorn Ordnance Works, Marshall, Tex., increased the membership of the board to ten and elected Robert Lang, a substantial stockholder, as the new director.

J. S. Jorczak, manager of the technical service and production departments, was named a vice president of the corporation at the same meeting.

Gaboury and Manker Advanced

The appointments of M. N. Gaboury as plant manager and F. B. Manker as assistant plant manager of the Bound Brook, N. J., plant have been announced by L. C. Duncan, general manager, organic chemicals division, American Cyanamid Co., Rockefeller Center, New York 20, N. Y.

Mr. Gaboury had been associated with Newport Co., Swann Co., and Bakelite Co. before joining Cyanamid's organic chemicals division in 1933. Mr. Gaboury worked in various supervisory capacities in the manufacture of azo and vat dyes. In 1950 he was promoted to manager of the color department of the Bound Brook plant. The new plant manager is an active member of the American Institute of Chemical Engineers.

Before coming to the Bound Brook plant, Mr. Manker had been general superintendent of Canadian operations for the Barrett Division of Allied Chemical & Dye Corp. He has been managing various manufacturing units since his arrival at Bound Brook in 1941 and was named production manager of related coal-tar products in 1952. Mr. Manker is a member of AICE, and the Compressed Gas Association and is treasurer of the Plainfield Engineering Society.

Wellman in New Post

V. E. Wellman has been named manager of the petrochemicals and the intermediate and rubber chemicals departments of the organic chemicals division at Bound Brook. Mr. Wellman, who was associated with The B. F. Goodrich Co. until joining the Calco Chemical Division of Cyanamid in 1945, rose through the posts of associate director of process engineering, director of process engineering, and assistant manager of the intermediate and rubber chemicals department of the company before being promoted to his current position.

Naugahyde Licenses Granted

Four more manufacturers of vinyl coated fabrics have been licensed to produce and sell Elastic Naugahyde, the stretchy vinyl upholstery with elastic fabric backing of the United States Rubber Co., Rockefeller Center, New York 20, N. Y. This action brings to eight the number of manufacturers so licensed.

The new companies are Goodall-Sanford, Inc., Reading, Mass.; Columbus Coated Fabrics Corp., Columbus, O.; Athol Mfg. Co., Athol, Mass.; and Pantasote Co., Passaic, N. J.

Armour in Rubber Research

Laboratory facilities of the chemical division, Armour & Co., Chicago, Ill., have been expanded to include a rubber research section, according to a recent announcement. Objective of the new section, which is under the supervision of S. N. Pinhasik, is to develop new applications for the company's fatty acids and their derivatives for rubber and plastics.

Roger S. Firestone, president of Firestone Plastics Co., Pottstown, Pa., is the new president of the Valley Forge Council, Boy Scouts of America.

Azelaic Acid Available

Emerox 1110, the dibasic azelaic acid manufactured at the new ozone-oxidation plant of Emery Industries, Inc., Cincinnati, O., is now commercially available from the company. The chemical is produced from oleic acid by oxidation at the ethylenic linkage to form an ozonide which subsequently decomposes to yield two nine-carbon aliphatic acids, azelaic and pelargonic.

Specifications given for Emerox 1110 include: acid value, 565; combining weight, 100; melting point, 95-99° C.; color, 5 FAC; specific gravity, 1.038 @ 110° C.; azelaic acid content, 87%; and content of other dibasic acids, 13%.

Stowe-Woodward in South

A 16-acre tract of land in Griffin, Ga., on which will be constructed a new plant for manufacturing highly specialized rubber roll coverings, has been purchased by Stowe-Woodward, Inc., Newton Upper Falls, Mass. The facility, when built, will make the company's rubber covered rolls more readily available to the paper and textile industries of the South. Although drawings for the new plant are not yet complete, plans contemplate a structure covering 25,000-30,000 square feet.

Schlosser & Co. Established

The firm of Berlow & Schlosser has been dissolved following the recent death of Charles Berlow. H. A. Schlosser will, however, continue to supply chemicals and other materials to industry through the firm of H. A. Schlosser & Co., 401 Industrial Bank Bldg., Providence 1, R. I.

BWH Midwest Warehouse

To speed Midwest deliveries of its belting, hose, and other mechanical rubber goods, Boston Woven Hose & Rubber Co., Cambridge, Mass., has opened a new warehouse at 2651 Gardner Rd., Broadview, near Chicago, Ill.

OBITUARY

Elton H. Coon

A SUDDEN heart attack while he was playing curling caused the death, on January 6, of Elton H. Coon, general merchandise manager, industrial products and automotive accessories division, Gutta Percha & Rubber, Ltd., Toronto, Ont., Canada.

The deceased was born November 17, 1895, at Elgin, Ont. He attended the local high school and Queen's University and was graduated from the latter in 1921 in metallurgical engineering, with a B.Sc. degree.

Mr. Coon started his successful career with the rubber company in its planning department on January 3, 1922. He became, successively, superintendent of manufacturing, tire department; supervisor of the merchandising department (November,

1937); manager, mechanical goods department (September, 1946); sales manager, mechanical department (1952); sales manager, industrial products and automotive accessories division (1953); and general merchandise manager of the division (June 16, 1953).

In World War I, Mr. Coon served overseas with the 6th Field Company of the Royal Canadian Engineers and with the Royal Artillery as a gunner officer; in World War II he was a Reserve Captain in R.C.E. He was also a past president of High Park Curling Club and a member of the Royal Military Institute.

Funeral services were held at a Toronto funeral home on January 9, followed by interment in Necropolis, Toronto.

Survivors include the widow, two daughters, his mother, and two brothers.

Charles Almy

CHARLES ALMY, co-founder of Dewey & Almy Chemical Co., Cambridge, Mass., died on January 24 in a Massachusetts hospital, following a short illness. Mr. Almy had retired on December 31, 1953, after five years as a consultant to the firm.

He was born in Cambridge on April 6, 1888. Mr. Almy was graduated from Harvard in 1908 and from Massachusetts Institute of Technology as a chemical engineer in 1910.

Following service in the Chemical Warfare Service, United States Army, in World War I, Mr. Almy, together with Bradley Dewey, formed Dewey & Almy Chemical Co. in 1919. The deceased was concerned with the development of the company's business in both this country and abroad. In addition to being a director and member of the executive committee of the corporation, he was executive vice president until 1948.

Mr. Almy was widely known for many trade paper articles and for his activities in many professional associations and civic groups.

Funeral services were held at the First Parish Unitarian Church in Cambridge on January 25.

Surviving is his wife.

William L. Pitcher

WILLIAM L. PITCHER, 82, president of United Elastic Corp. and Easthampton Rubber Thread Co., Easthampton, Mass., died at his home there on February 13. Funeral services were held in Easthampton on February 15.

Mr. Pitcher, son of the late Franklin W. Pitcher, fromer head of Easthampton Rubber Thread, went into business with his father after graduating from Williston Academy. The deceased served as president, treasurer, and general manager of the thread concern and also as president of United Elastic, which was founded in 1927.

He was also a director of Industrial Mutual Insurance Co., Boston; Smith-Lee Corp., Oneida, N. Y.; Beaver River Power Co. and Latex Fiber Industries, both of Beaver Falls, N. Y.; and of First National Bank, Northampton. For more than 50 years Mr. Pitcher was treasurer of Easthampton Cooperative Bank; he was also a vice president of Easthampton Savings Bank.

He leaves a daughter, a brother, and a sister.

Aubrey W. Phillips

Aubrey W. Phillips

AFTER a long illness Aubrey W. Phillips, general manager of manufacturing, The General Tire & Rubber Co., Akron, O., passed away February 1 at a Baltimore, Md., hospital.

Mr. Phillips, who was born in East Fairfield, O., 53 years ago, started his career in rubber in 1915 with McGraw Tire & Rubber Co. as a factory worker. Next he was with Columbiana Rubber Co. for a short time before spending one year (1919) in the U. S. Merchant Marine. In 1920 the deceased joined Mason Tire & Rubber Co. as a foreman and was production superintendent when he resigned in 1928 to go to The B. F. Goodrich Co. He was general superintendent of the tire division there when he left for General Tire in February, 1946. He served first, for several months, as assistant to the vice president in charge of manufacturing before becoming general manager of manufacturing at General Tire.

Mr. Phillips was a member of Tadmor Shrine; Rockton Lodge (Blue Lodge); American Ordnance Association; Society of Automotive Engineers; Akron Chamber of Commerce; and Akron City and Portage Country clubs. He also attended Harvard Graduate School of Business Administration.

He leaves his wife, his mother, a son, and a brother.

David W. Moore III

A HEART attack caused the death, on February 13, of David W. Moore III, vice president and a director of Pioneer Latex & Chemical Co., Middlesex, N. J. Funeral services and burial took place on February 16 in North Plainfield, N. J., where the deceased had maintained his residence.

He was born in Clayton, N. J., on May 23, 1900. He was educated at Blair Academy and Cornell University, from which he was graduated in 1924.

Mr. Moore worked for the Flintkote Co. from 1930 until 1947, when he went to Pioneer Latex.

He belonged to several organizations including American Chemical Society, New York Rubber Group, Area Managers Conference, and Seal & Serpent.

Survivors include the widow, a brother, and a sister.

Charles J. Durban

STRICKEN while on a business trip, Charles J. Durban, advertising and sales promotion executive with United States Rubber Co., New York, N. Y., died in a Norfolk, Va., hospital on February 10.

He had been with the rubber company since 1937, when he started as a special representative in the tire division. In 1939, Mr. Durban became manager of tire advertising and sales promotion; in 1943 he was made assistant advertising director of the tire division and in 1944, assistant and vertising director of the company.

The deceased was born in Philadelphia, Pa., 61 years ago. He attended Friends Central School and Germantown Academy.

Mr. Durban served as president of the American Television Society and was a member of the Lambs. He was also first chairman of Little League baseball and was League president for several years until a full-time head was named last year.

Funeral services were held February 13 at Fairchild Funeral Home, Manhasset, Long Island, where Mr. Durban lived for the past 12 years.

He is survived by his wife, a daughter, a son, a sister, and four grandchildren.

James O. Meyers

JAMES O. MEYERS succumbed to an unexpected heart attack on January 30. He was head of James O. Meyers & Sons, Buffalo, N. Y., which he had founded in 1933 as a manufactrers' representative and distributor of chemicals.

The deceased was born in Buffalo on June 22, 1885. He was graduated in pharmacy in 1907 from the University of Buffalo and two years later received a degree in chemistry.

He operated his own business as a pharmacist for 10 years and then worked as a chemist.

Mr. Meyers was a past president of Kenmore Lions Club and of Buffalo Paint, Varnish & Lacquer Association; a director of the Buffalo Rubber Group; and a member of American Chemical Society, State Pharmaceutical Association, Holy Name Society, and the University of Buffalo Alumni Association.

A Solemn Requiem Mass was celebrated on February 2 at St. John the Baptist Church, followed by interment in Mt. Olivet Cemetery, Tonawanda, N. Y.

He is survived by his wife, three daughters, two sons, two brothers, two sisters, and 21 grandchildren.

Jacques Wolf

JACQUES PHILLIP WOLF, founder and president of Jacques Wolf & Co., Passaic, N. J., died on January 26 at his Montclair, N. J., home after several years' illness.

Mr. Wolf was born in Muhlouse, France, in 1873. He came to the United States in 1901.

He began his career in the chemical business with a partner, Abran De Ronde, under the firm's original name, Wolfe & De Ronde.

The deceased was also a member of the Chemists' Club of New York and a member and a director of the French Chamber of Commerce in this country.

Funeral services were held in Montclair on January 29, with interment at that location.

Surviving is a cousin.

CASE HISTORY

Another tough problem solved by an Emery Product

HOW EMERSOL® OLEIC ACID ELIMINATED ODOR AND COLOR OF FOAM RUBBER

No one likes to sleep with a clothespin on his nose. That's why it was important to avoid odor in foam rubber. In this particular case it was easy. Replacing an ordinary double-distilled oleic acid with Emersol 233LL Elaine, eliminated odor due to rancidity. Likewise, the superior color stability of 233 gave the product maximum resistance to yellowing.

In addition, its low metal content resulted in highest service life, avoiding the acceleration of resinification of the rubber caused by minute traces of metallic impurities.

Whatever you make, foam rubber or an entirely unrelated product, the superior color stability, oxidation stability, and resistance to rancidity of all Emersol Oleic Acids can make your product better, stay better longer. The net result: your product will have consumer appeal... be easy to sell. And since they cost no more than competitive grades, next time...everytime...it will pay you to buy Emersol Elaines!

What Does Emersol Mean? Emersol, a contraction of the words "Emery" and "Solvent", describes Emery's exclusive process of solvent separation of fatty acids. Of more significance, however, is its meaning in terms of product performance. Because of this unique process, the use of automatic controls and of corrosion resistant metals throughout, Emersol Stearic and Oleic Acids are purer, more uniform, of "controlled" composition, and freer from metal contamination and other impurities that promote oxidation, rancidity and yellowing.

Because all these advantages carry over into your finished products, to you, Emersol actually means better products...products that stay better longer... products that are easier to sell.

Emery

Fatty Acids & Derivatives
Plastolein Plasticizers
Twitchell Oils, Emulsifiers

Emery Industries, Inc., Carew Tower, Cincinnati 2, Ohio

Export: 5035 RCA Bldg., New York 20, New York
New York • Philadelphia • Lowell, Mass. • Chicago • San Francisco
Schibley & Ossmann, Inc., Cleveland • Ecclestone Chemical Co., Detroit

Warehouse stocks also in St. Louis, Buffalo, Baltimore and Los Angeles

NEWS ABOUT PEOPLE

Lawrence E. Stanton

Lawrence E. Stanton has been appointed technical service representative for the southern states by Marbon Corp., Gary, Ind. Prior to joining the company in January, 1952, Mr. Stanton had been a laboratory technician for the United States Rubber Co. Chicago plant. While with Marbon, Mr. Stanton has undergone an intensive training program in its technical laboratories. Marbon, a subsidiary of Borg-Warner Corp., supplies high styrene resins to the rubber, paint, and plastics industries, as well as rubber-to-metal adhesives.

Carl Davidson, since 1952 manager of the training department for Goodyear Tire & Rubber Export Co., recently retired after 42 years with the Goodyear organization. He started as a general-line salesman in Cleveland in 1912 and since 1913 was associated continuously with Goodyear operations outside the United States. After business surveys in Latin America and the Far East, in 1917 he opened the company branch in Java and later was made director of this subsidiary. Next he went to Goodyear-Canada and then to the Philippines, where he opened a branch warehouse in 1919. Eventually Mr. Davidson was placed in charge of sales for all the Far East, and in 1921 he became manager of Goodyear-Philippine Islands. He returned to Akron in 1932, was named assistant manager of the Latin American division of the Export company, was transferred to assistant manager of the western division in 1936, and was promoted to manager of the Caribbean division in 1945.

W. F. Lang has been appointed sales manager of the foam rubber and industrial sponge rubber division of The General Tire & Rubber Co., Akron, O. For the past 14 years, Lang was with Sponge Rubber Products Co., Shelton, Conn., serving as sales manager the last eight years. In his new position with General Tire he will be responsible for sales of latex foam rubber, and of rubber products to the shoe industry and other industries using similar applications. He will eventually headquarter at General's Marion, Ind., plant where the division's products are manufactured. For the present he is at General's New York office, 320 Fifth Ave.

J. D. McPherson has been named manager of the manufacturers chemicals department, American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N. Y. McPherson had been technical director and assistant manager of the department. In 1945 he joined Cyanamid's engineering department and later was made assistant to the director of purchases in the general purchasing department. He was transferred to the industrial chemicals division in 1952, where he first served as sales supervisor of organic acids and plasticizers. Cyanamid's manufacturers chemicals department produces materials for the chemical and metal processing industries, including nitriles, cyanamide and derivatives, prussiates, surface active agents, metallic stearates, phthalic anhydride, ethyl lactate, and metal heat treating salts.

C. L. Kenny has been named manager of products, Quaker Rubber Corp., division of H. K. Porter Co., Inc., Philadelphia, Pa. Mr. Kenny has been associated with the rubber industry for the past 20 years, serving in such capacities as production control manager and assistant to the director of manufacturing for an industrial rubber company. With Quaker since 1947, he has held various special assignments, both in the field and the factory. In 1952 he became manager of the horizontal braided hose department and was instrumental in developing a complete line of horizontal braided hoses. In his new position Mr. Kenny will coordinate the activities of the factory with those of the sales force to improve further Quaker's service to industry.

Albert M. Fiala has been named manager of special industrial merchandise, The B. F. Goodrich industrial products sales department, Akron, O. His new duties include responsibility for the sale of rubber clothing, matting, electrical tape, and silage caps. Fiala joined Goodrich in 1915 as a factory employee. Following two years' military service during World War I, he returned to Goodrich in its industrial products sales department. He was sales promotion manager of industrial products from 1920 to 1925 and an industrial products salesman for 14 years. In 1939, Fiala became manager of latex foam product sales and in 1950 was named manager of government sales for the industrial products sales department.

Felix Salamon has joined the sales staff of Acme-Hardesty Co., 60 E. 42nd St., New York 17, N. Y., producer of stearic acid, red oil, glycerine, and animal and vegetable fatty acids. Recently Mr. Salamon acted as a manufacturers' representative, covering chemicals for several prominent concerns. Prior to that time he had been associated with Binney & Smith Co. for more than 22 years, where he was in charge of sales for the rubber compounding accessories department, specializing in fatty acids, chemical plasticizers, and specialty materials.

John B. Harris, Jr., has been named sales representative of Columbia-Southern Chemical Corp. for the Cleveland district. Mr. Harris was formerly with the firm's Pittsburgh sales office.

L. R. O'Rourke

L. R. O'Rourke has been appointed New York district sales manager by Pennsylvania Industrial Chemical Corp., Clairton, Pa. Previously he had been a sales representative with headquarters at the company's plant at Chester, Pa. Before joining Pennsylvania Industrial ten months ago, Mr. O'Rourke had served in research, production, and sales capacities with Falk & Co. and Cargill, Inc.

T. M. Hughes has been appointed to the newly created post of manager of dealer operations, and **George A. Wiedemer** to the special assignment of sales training manager at Seiberling Rubber Co., Akron, O. Hughes, who has been assistant to General Sales Manager Walter T. Johnson, will handle sales program details, pricing, and sales of other than first-class merchandise. Hughes is a 32-year employe of Seiberling and has had widespread experience in many branches of the sales department. He was named to his staff position in 1948, after having served as manager of accessories and repair materials sales and manager of commercial sales.

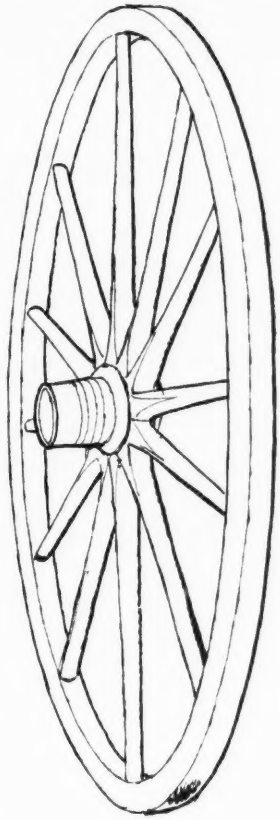
Wiedemer, truck tire sales manager until he retired last July, returned to the company to train new salesmen and dealer personnel. He also joined the company 32 years ago and has been Chicago district manager, manager of commercial sales, service manager, and was truck tire sales manager for nine years before he retired.

Harry S. Komer has been appointed superintendent of the Anaheim, Calif., chemical materials department's plant of General Electric Co. Mr. Komer, a member of G-E since 1945, was supervisor of payroll and costs and later supervisor of finance at Anaheim before this promotion.

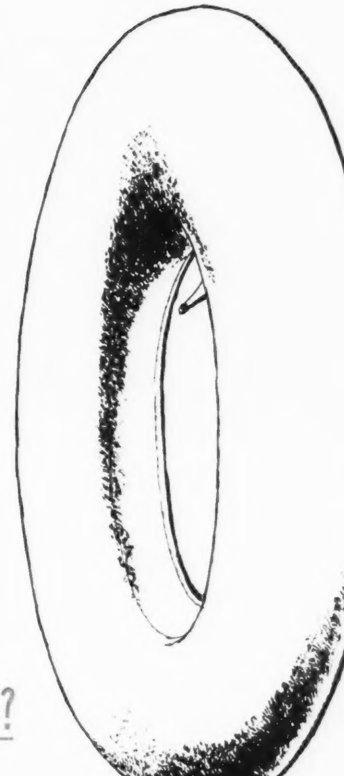
Bill White, salesman and assistant to the vice president in charge of Canadian business, has been appointed divisional sales manager for I. B. Kleinert Rubber Co., New York, N. Y. Mr. White will be responsible for sales in New England and New York State and will continue also with his Canadian assignment.

THE HISTORY OF THE RUBBER INDUSTRY—Number 7

how long did it take to get from here



to here?



Answer: Two years.

The principle of an inner tube is simple, and of such ancient application that it could not be patented.

Inner tubes, as we think of them today, were probably used about 1890. By 1892—two years later—they were being used widely, and beginning to appear as the detachable tube, for double tube tires, and the vulcanized-in type, used in single tube tires.

Two Monsanto accelerators, Thiofide (powder) and Thiofide S (seeds), can be used successfully in a wide variety of stocks. The seeds give maximum speed and completeness of dispersion. For more information about these accelerators and other products, see catalog "Monsanto Chemicals for the Rubber Industry." If you do not have a copy, write to MONSANTO CHEMICAL COMPANY, Rubber Service Department, 920 Brown Street, Akron 11, Ohio.

MONSANTO CHEMICALS FOR THE RUBBER INDUSTRY

ANTIOXIDANTS

Flectol* H
Santoflex* B
Santoflex BX
Santoflex 35
Santoflex AW
Santowhite* Crystals
Santowhite MK
Santowhite L

ALDEHYDE AMINE ACCELERATORS

A-32
A-100

MERCAPTO ACCELERATORS

Santocure*
El-Sixty*
Mertax (Purified Thiotax)
Thiotax (2-Mercapto benzothiazole)
Thiofide* (2,2' dithio-bis benzothiazole)

GUANIDINE ACCELERATORS

Diphenylguanidine (D.P.G.)
Guantal*

ULTRA ACCELERATORS FOR LATEX, ETC.

R-2 Crystals
RZ-50
RZ-50-B
Pip-Pip
Thiurad* (Tetramethyl-thiuram disulfide)
Ethyl Thiurad (Tetraethyl-thiuram disulfide)
Mono Thiurad (Tetramethyl-thiuram monosulfide)
Methasan* (Zinc salt of dimethyl dithiocarbamic acid)
Ethasan* (Zinc salt of diethyl dithiocarbamic acid)
Butasan* (Zinc salt of dibutyl dithiocarbamic acid)

SPECIAL MATERIALS

Thiocarbanilide ("A-1")
Santovar*-A
Santovar-O
Sulfasan R
Insoluble Sulfur "60"

COLORS

REODORANTS

Reg. U. S. Pat. Off.

MONSANTO
CHEMICALS — PLASTICS
SERVING INDUSTRY...WHICH SERVES MANKIND

Max O. Debacher has been appointed assistant manager of overseas plastics manufacture for Monsanto Chemical Co., Springfield, Mass. Mr. Debacher entered the industry in 1937 with Fiberloid Corp. and became associated with Monsanto when that company acquired Fiberloid. As a member of Monsanto's research department, he served as group leader for Saflex polyvinyl butyral from 1947 to 1949, when he joined the sales department. Since 1951, Mr. Debacher has been assistant manager for the sale of Saflex.

C. M. Christie, founder and president of American Latex Products Corp., Hawthorne, Calif., a subsidiary of Dayton Rubber Co., Dayton, O., has been reelected to the board of directors of the parent organization for a three-year term. Mr. Christie has long been associated with the rubber industry. He was very active in the market development of foam rubber in the fields of aircraft and theater seating and in the furniture and shoe industries. With the latex firm, which he founded in 1945, he has been credited with a number of applications of rubber to aircraft uses.

Alf E. Werolin, vice president in charge of administration and planning, National Motor Bearing Co., Inc., Redwood City, Calif., has been elevated to the post of vice president and general manager of the company, thus relieving President Lloyd A. Johnson, who is also chairman of the board, of the duties of general manager. Mr. Werolin, who came to the California company in September, 1951, gained his business experience with American Piano Co., Western Electric Co., and McKinsey & Co.

Wilbur E. Combs has been appointed assistant manager of sales development in the mechanical goods division of United States Rubber Co., Rockefeller Center, New York 20, N. Y. Mr. Combs, who has been with the company in various sales positions since 1945, will be in charge of development and production of programs to be used by field sales organizations of the division. Most recently he had served as merchandising manager of New York Belting & Packing Co., Passaic, N. J., since January, 1953.

John W. Solomon has resigned as sales assistant to W. E. Clark, vice president and general manager of the textile division of United States Rubber Co., in order to accept the position of vice president of Monarch Rug Mills, Dalton, Ga. Mr. Solomon joined the rubber company in 1947 as general sales manager and was appointed to the position from which he resigned in 1953. Succeeding him is his former assistant at the Chattanooga, Tenn., sales office, **H. E. Anderson.**

Thomas J. LaBounty, formerly vice president and sales manager of Multiplastics, Inc., has joined Logo, Inc., Chicago, Ill., to work on market analysis and market development directly under Logo's president, M. A. Self.

William Cole, sales manager of Fabric Fire Hose Co., Sandy Hook, Conn., has been named vice president and general manager of the company, a subsidiary of United States Rubber Co. Mr. Cole rejoined the company in 1950 after having served in the Navy during World War II.

A. E. Powell

A. E. Powell has joined the sales staff of Alco Oil & Chemical Corp., Philadelphia, Pa., where he will assist in the development and service of new products. Mr. Powell has been associated with the rubber industry since 1930, first with United States Rubber Co., then with the Flintkote Co. as chief chemist and sales serviceman, and finally with Pioneer Latex & Chemical Co. His last position with Pioneer was as treasurer and vice president in charge of rubber sales.

Alwin C. Eide has been elected a director of American Zinc, Lead & Smelting Co., Columbus, O., to fill the vacancy caused by the death of **V. C. Bruce Wetmore.** Mr. Eide started with the company in 1916 as a research chemist at Hillsboro, Ill. He held a similar job at Caney, Kan.; then the company transferred him to St. Louis, where he spent three years in the metallurgical department. After four years as manager of the Chicago sales office he came to Columbus as sales engineer and served as such about 15 years. Mr. Eide has been manager and later vice president of American Zinc Sales Co. and of American Zinc Oxide Co. since 1944. He was elected vice president of the parent company in 1950.

Warren C. Lothrop has been appointed vice president of Arthur D. Little Co., Cambridge, Mass., in which capacity he will be in charge of the research and development division of that company. Prior to joining Little in 1946, Dr. Lothrop had served as technical aide on the National Defense Research Committee.

Howard C. Sauer, general manager of the export division of The Timken Roller Bearing Co., Canton, O., has been elected a director of the Overseas Automotive Club, of which he is also a past president. Mr. Sauer was instrumental in helping organize Timken's export division.

William Carpenter has been named sales manager of the St. Louis district for Columbia-Southern Chemical Corp., Pittsburgh, Pa. Mr. Carpenter, a member of that sales district staff since 1948 and acting manager since last year, replaces **Brooks M. Dyer,** now assistant director of sales for the corporation.

Lawrence H. Holden, Jr., has been assigned to the Cleveland district office of Pittsburgh Coke & Chemical Co., Pittsburgh, Pa., as a plasticizer sales representative. Mr. Holden recently completed the company's sales training course.

Joe S. Gilliam has been named manager of government sales for The B. F. Goodrich Industrial Products Division, Akron, O. Gilliam joined Goodrich in 1948 with an assignment in the company's works technical group, manufacturing services, Akron. In 1949, he was assigned as engineer in the inflatable products department and in 1950 became a sales engineer for the company's automotive, aviation, and government sales division.

R. W. Richardson has been named vice president of The Kelly-Springfield Tire Co., Cumberland, Md. Mr. Richardson, who previously had been assistant to President E. S. Burke, came to the company in July, 1952, from The Goodyear Tire & Rubber Co., Akron, O. His experience covers a variety of sales and managerial positions during 18 years with Goodyear.

Thomas Zawadzki has been appointed, by Firestone Plastics Co., Pottstown, Pa., sales representative to the wire and cable industry, specializing in the sale of the electrical grades of Exon vinyl resins and compounds. Mr. Zawadzki will make his headquarters at Pottstown and will contact wire and cable manufacturers throughout the United States. He was formerly with General Cable Corp.

Sam I. Roudebush has been named resident plant manager of Productos de Caoucho Villegas, S. A., the new tire manufacturing firm being established in Bogota, Colombia, by Seiberling Rubber Co., Akron, O., and a group of Colombian investors. Roudebush, who joined the rubber company a year ago as assistant manager of tire design, had spent more than three years in Bogota as technical adviser for The B. F. Goodrich Co. During his business career he worked for five years as a civil and mechanical engineer in the railroad and steel fabricating fields and has spent the last seven years in technical and development work in the rubber industry.

R. W. Cretney has been made vice president and general manager of Thermatomic Carbon Co., a carbon black manufacturer affiliated with Commercial Solvents Corp. Associated with Thermatomic since its founding in 1923, Mr. Cretney succeeds **Clark Boardman,** who recently retired. Also announced was the appointment of **S. S. Gill** as manager of the company's Sterling, La., plant.

Samuel N. Johnson and **Henry J. Digester** have been named project engineer and process engineer respectively in General Electric Co.'s chemical materials department, phenolic products plant, Pittsfield, Mass.

Jerome Been, technical director of Rubber & Asbestos Corp., Bloomfield, N. J., has been elected vice president of the company. Mr. Been joined the corporation in 1946 after extensive technical experience in allied industries.

(Continued on page 836)

NEWS FROM ABROAD

GREAT BRITAIN

Progress in T.C. Rubber Reviewed

Since 1949, when Technically Classified rubber[1] was first produced on a commercial scale by the Socfin company in Malaya (after preliminary work with M. Boquet, of the Terres Rouges company of Indo-China) to the end of June, 1953, a total of 54,847 tons of classified rubber has been put on the market, R. G. Newton, coordinator of Technically Classified rubber, shows in a recent review of the subject.[2] Output (in long tons) by the various producing countries during this period was as follows:

Year	Malaya	Indo-China	Indonesia	World Total
1949	1,584	.....	...	1,584
1950	975	2,813	...	3,788
1951	5,518	3,335	...	8,853
1952	17,102	7,443	50	24,595
1953 (half)	10,780	4,447	800	16,027
Total	35,959	18,038	850	54,847

Malaya, with the greatest output at present, has two T. C. stations, the original one set up for the Socfin company and that set up by the Rubber Research Institute of Malaya at Kuala Lumpur.

Smallholder Rubber Being Classified

The R. R. I. has developed the blended-bale procedure for preparing uniform bales of smallholder rubber as well as an improved testing method by which results are obtainable in 3-4 hours instead of about 2-3 days. So far more than 1,000 tons of smallholder RSS 3 rubber have been classified by the blended-bale technique. Though the extra work involved in this procedure necessitates a slight addition to the price of these grades, continuing consumer interest indicates that improved uniformity, permitting savings in certain costs, more than offset the higher price, and it is expected that TC FAQ sheets will eventually be as well established as TC RSS 1. Smallholder RSS 3 in Malaya is mostly of the "blue" type (faster vulcanizing). Remilled rubber is now also being classified, and the first shipment was packed November 19, 1953.

Indo-China has five active test stations for T.C. rubber. The coordinating center is operated by Institut des Recherches sur le Caoutchouc en Indochine, at Laikhe, where check-tests with four privately owned centers are conducted, and fundamental studies are carried out. Of the private stations, two are owned by the Terres Rouges concern, one by S.I.P.H., and the fourth by S.I.P.R.M. At least two more test stations are in prospect.

Although much preliminary work had been carried out in Indonesia, no T.C. rubber was exported until 1952. The I.N.I.R.O., at Bogor, Java, is the coordinating center, but the C.P.V. (Experiment Station for the Central Association of Experiment Stations) makes the tests for Javanese estate rubber, classification of which has progressed to the extent that output is now at the rate of about 1,000 tons monthly. In Sumatra the A.V.R.O.S. has a test station at Medan, and shipments of T.C. rubber are expected to begin shortly. A test station is also being set up for smallholder rubber.

In Thailand a test station is now under construction. Funds for its equipment have been provided by the Mutual Security Agency of the United States Government.

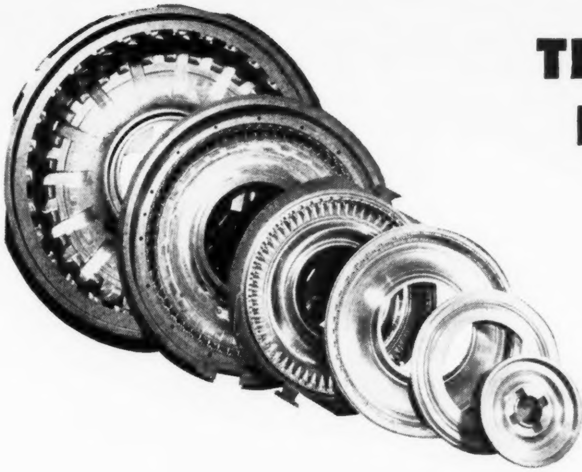
Finally, the Rubber Research Institute of Ceylon has set up a station at Dartonfield where basic survey work is now being undertaken.

Consumer Reaction to T.C. Rubber

In regard to consumer reaction, Dr. Newton finds that with few exceptions, "the user generally does not know *exactly* what he wants"; for instance, consumers mean entirely different things when they insist on more uniform natural rubber. The difficulty seems to be largely one of terminology and differing judgments which, as Dr. Newton's examples indicate, obviously stem from the fact that individual concepts of uniformity, for instance, differ in accordance with individual requirements, with what happens to be the most pressing problem, in this respect, for a given technologist in making his particular product.

Dr. Newton finds that many technologists at first prefer the

[1] See India RUBBER WORLD, May, 1950, pp. 175-76.
[2] *India Rubber*, J., Export No., Dec. 5, 1953, p. 34.



TIRE MOLD MAKING IS OUR ONE JOB *at the* ATHENS MACHINE COMPANY

In Athens, Ohio, the Athens Machine Division of Bridgwater Machine Co. is equipped to give the automotive tire industry finer mold making service than it has ever known.

We've always been able to give immediate and individual attention to our customers' orders . . . we made that our obligation to the tire industry when we began making molds nearly half a century ago. In upholding it, we not only kept abreast of tire development, but took the lead in metal working and machine tool advancement, as applied to tire mold making. Today, at Athens, tire mold manufacturing is our only production. That's why every year finds us able to serve your mold requirements even better than ever.

Specialization at Athens permits more and better machine tools, uninterrupted "flow" along our production lines, and the development of unsurpassed skills among our craftsmen. Specialized and automatic machine tools of our own design help keep your mold costs down by eliminating many otherwise necessary cutting, grinding and finishing operations.

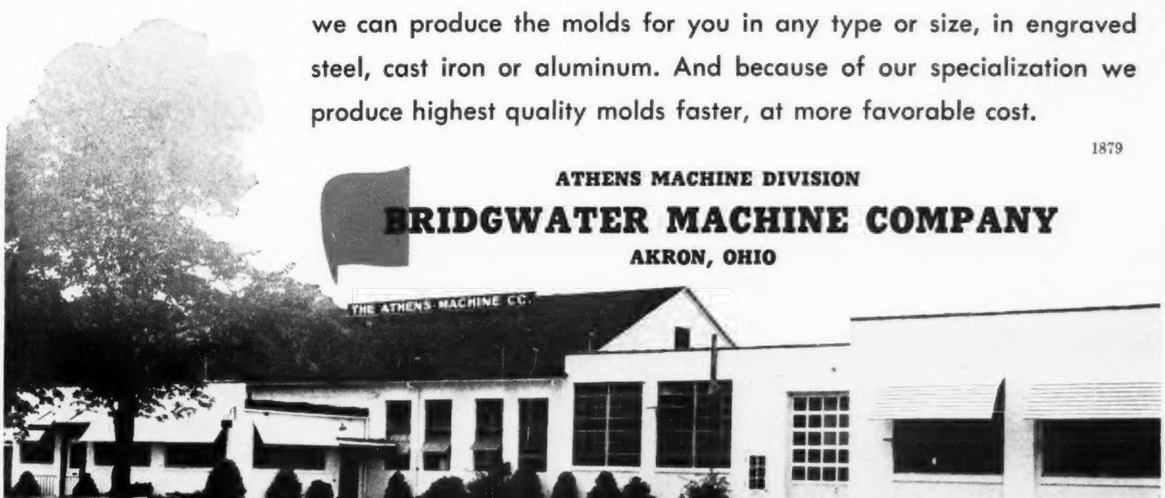
Whatever your mold requirements might be . . . passenger tires . . . off-the-road treads . . . something "different" in tires for special applications . . . at Athens we can produce the molds for you in any type or size, in engraved steel, cast iron or aluminum. And because of our specialization we produce highest quality molds faster, at more favorable cost.

1879

ATHENS MACHINE DIVISION

BRIDGWATER MACHINE COMPANY

AKRON, OHIO



medium-vulcanizing (yellow) T.C. rubber on grounds of habit or safety, but often develop an interest in the fast-curing "blue" type (with higher modulus at given cure) when they realize it has interesting properties of its own—in fact the growing interest in "blue" rubber has led some French investigators to foresee a future trend in improved natural rubber toward specially-high-modulus types.

As a result of consumer comment, producers have recently begun to reduce the spread of classes by tightening up the central "yellow" class and placing outer limits on the slow-curing "red" and fast-curing "blue" types. As a result of the latter step, undesirable types as "skin rubber" will be eliminated from Technical Classification.

Opinions by consumers are sometimes unexpected and Dr. Newton quotes the case of the technologist who was enthusiastic over his first special order of T.C. rubber because of its cleanliness and packing (by comparison with earlier purchases of go-down packed rubber). Then there was the French manufacturer who preferred the slow-curing "red" type because it gave an appreciably higher rate of extrusion.

The latter experience leads Newton to a discussion of the reasons for deleting the Mooney test and to the conclusion that though this step has brought advantages, the instance of the French consumer's experience indicates that something may have been lost. Certainly it indicates that individual consumers find their own ways of utilizing the specific properties of rubber for their own special purposes and that proper evaluation of their experiences and preferences will open new perspectives for T.C. rubber, and, reciprocally, consumer experiences with T.C. rubber will suggest further new uses as well as improved methods.

Company Notes

Enfield Cables, Ltd., Brimsdown, Middlesex, recently completed shipment to Soviet Russia of an important order for insulated cables received last July. The order—which went out one month ahead of the scheduled dates for delivery specified by Russia—called for 230 kilometers (route length) of different types of power cable, 100 kilometers (route length) of multicore signaling cables, and about 12,580 loop kilometers of telephone cable. This material has been designated "non-strategic in content."

A new £1,000,000 plant for the production of polyvinyl and copolymer resins has just been put into operation at the Aycliffe (Co. Durham) works, by the Bakelite company. This is another step forward in the aim of making Britain self-sufficient in regard to these resins.

It is understood that Dunlop Tire & Rubber Co., Ltd., London, proposes a new issue of £7,000,000 5½% preference shares, and a bonus issue to ordinary of one for two, involving £6,000,000 from reserves. In addition, all existing preference shares would be converted to one type 5½% preference share. The total issue capital of the company would then be £33,500,000.

Licences to import synthetic rubber from dollar areas have hitherto been issued by the Board of Trade only for export or defense orders. But recently it was announced that up to June 30, 1954, licences will also be made available for small quantities of such imports for all purposes, including general use on the home market. An early result of this move has been the decision of Dunlop Rubber Co., Ltd., to start making Butyl inner tubes for the home market also.

The British Rubber Development Board has opened a competition for students in the design of upholstered latex foam furniture of any form, for the home, public buildings, hotels, etc. The Board offers a first prize of £50, and there are other prizes of £25, £15, and £10.

Monsanto Chemicals has formed a wholly owned subsidiary, Monsanto Plastics, with headquarters in London, for the purpose of consolidating and extending Monsanto activities in the plastics fields here.

MALAYA

Lockwood Sees Higher Price for GR-S

"When the synthetic rubber industry is handed over to private enterprise, Malayan rubber producers can compete. But until then, they must be protected," Warren S. Lockwood, former head of and now consultant to the Natural Rubber Bureau, Washington, D. C., U. S. A., is quoted as stating in Singapore, while on a

visit to the Far East to learn at first hand about rubber conditions. He seemed to believe there was a good chance that the price of synthetic rubber would be raised this year and was confident that the American synthetic industry would be privately operated by April, 1955. An increase in the price of synthetic, he felt, was the only way to help the Malayan rubber industry and make it possible for Malaya to continue her social and political progress and her fight against Communism.

Both in Singapore and in Colombo, his previous stop on his Far Eastern tour, he showed optimism about the future of rubber. After leaving Malaya, he was also to go to Indonesia, Burma, and Siam.

Obviously Mr. Lockwood shares with many others the belief that synthetic will cost more to produce under private operation. In this connection a suggestion made in *Natural Rubber News*, for February, 1954, deserves mention; it is that in view of the prevalence of the above opinion, "a fair approach to the problem would be for RFC to engage an independent neutral firm of consulting engineers to make an objective, unbiased estimate of what GR-S would be sold for under private operation (assuming a fair sales appraisal figure), and that their findings be used to adjust the GR-S selling price to whatever level is recommended. The cost of such a survey might run into five figures . . . a small sum to dispel the doubts and skepticism which now exist in Southeast Asia regarding what they consider unfair pricing treatment by the U. S. Government."

Buffer Stocks Again

At the Rubber Study Group conference scheduled for Colombo, Ceylon, in May, a third attempt is to be made to establish an international rubber buffer stock, and Indonesian agreement is being sought by Malaya.

Rubber traders, particularly, are apparently convinced that an international agreement of this kind is the only means of stabilizing the natural rubber industry, it developed at a meeting of rubber men held in Kuala Lumpur about the middle of January. As is perhaps not unexpected, America was the target of attacks; leaders of the Malayan rubber industry were bitter over what they call America's "betrayal of faith." American delegates at International Rubber Study Group meetings opposed previous buffer stock plans because an international buffer stock regulated by the producing countries would end her power to depress prices to suit herself, they said.

While many seem to expect that Malayan-Indonesian agreement on joint action is possible and desirable, probably as many are skeptical about the matter.

It is interesting here to quote the opinion of Sir John Hay, managing director of Guthrie & Co., on buffer stocks. Sir John, in Malaya recently, pointed out that whatever support the idea of an international buffer stock may have, stems from the notion that it can serve to stabilize prices at a higher level than otherwise obtainable. But natural rubber producers no longer have a monopoly and cannot take unilateral action to raise prices for rubber without the risk of pricing it out of the market; the consumer now has a free choice of two products largely interchangeable, and price will be the deciding factor in the choice.

"It is of the essence of free enterprise that competition should act as a spur to endeavor and that rewards should go to the efficient," Sir John said. "The feverish search for 'trick solutions' is not a healthy sign and is no substitute for skilled hard endeavor."

Sir John showed that estates in Malaya had replanted 350,000 acres since the war; the fall in the price of rubber would check replanting in many cases, but, he thought, a period for consolidation and readjustment might make for sounder progress in the end.

The Taylor Wage Award

The arbitrator in the wage dispute between rubber workers' unions and employers, Justice Taylor, awarded rates for the first quarter of 1954 which amount to a cut of 25 cents in the daily wage of tappers and 15 cents in those of field workers, bringing the new pay rate for contract tappers to $2.55, for check-roll tappers to $2.25, and for field workers to $1.95 (Straits currency). The same scale is proposed for subsequent quarters; but if the price of rubber has been between 65 and 60 cents a pound, in a quarter, there is to be an increase of 10 cents in all wage rates in the next quarter; and if the price is not below 65 cents, the scale agreed on June 22, 1953, is to apply.

The new rates, which, incidentally, should save the rubber estates more than $15,000,000 a year, are the same as the employers offered—and the unions rejected—last December, before arbitra-

tion was decided upon, and naturally were not well received by labor.

As revealed by the Taylor report covering the award, the stand of the employers is that the decline in price is due to competition with synthetic rubber and is not temporary. They do not believe the price of rubber is likely to rise above the 65-60 cents level, and they cannot continue to pay wages agreed on when prices were between 70 and 65 cents, because many estates are already working at a loss. Costs must be cut, and since wages constitute by far the heaviest cost item, some reduction here is unavoidable. Estates which are not members of the M.P.I.E.A. (Malayan Plantation Industry Employers' Association) have already reduced wages and are paying only about two thirds the present Association rates.

The pay rates awarded by Justice Taylor are the postwar basic wage plus a cost of living allowance and are twice the rates paid in 1939; whereas the price of rubber is only twice as high, and total costs are three times as high. Data supplied by the employers for the F.O.B. costs of 148 estates over the first nine months of 1953 showed wide variation—the three highest were over 80 cents; the five lowest, under 40 cents; and the crude average 55 cents per pound. It is calculated that with the tax of eight cents per pound that must be paid when the price of rubber is 60 cents, the 1953 costs are about 63 cents a pound, so that at the current price (allowing for lower grades) of about 53 cents, the current loss is 10 cents a pound.

The unions, the report indicates, took the position that human values should outweigh economic considerations; that the owners can afford to pay prevailing wages even at lower prices. Employers' figures on costs were erroneous and misleading. In the unions' view an industry unable to pay a wage sufficient to maintain an adequate standard of living must reorganize, be subsidized, or go out of business. They suggested that the industry's economics could be improved by price fixing on the lines of the agricultural marketing boards in England, elimination of agency houses, and centralization of factories.

It may be noted that there are about 300,000 workers on rubber estates over 100 acres, and of these the M.P.I.E.A., with more than 500 members owning 900 estates having a total planted area of about 1,500,000 acres, employs 230,000 workers, of whom only 45,000 belong to one or other of the 17 registered rubber unions.

Although the data on costs submitted by both sides were admittedly hastily compiled and incomplete, Justice Taylor was satisfied that there was enough evidence to show that most estates were dipping into reserves to be able to continue operating and made his award accordingly. The proper course, he felt, was to fix the highest rate which efficient estates could maintain, and he had awarded the highest rates warranted by the conditions revealed by both parties. He recommended, however, that owners and unions, aided by professional accountants, examine the question of costs so as to control fluctuations in wages by reference to the margin between costs and proceeds, instead of to price.

Last reports indicate that the award is to be voted on by some of the unions; results were not expected before February 20.

Meanwhile it is learned that the first payments made at the new rates to 95,000 Chinese rubber workers were accepted without protest.

First Malayan Foam Rubber Factory

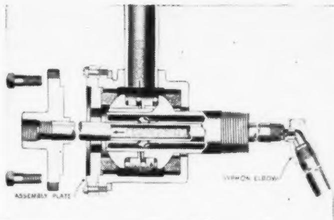
A local press report announces the establishment of the first foam rubber factory in the Federation. A Chinese engineer, Too Joon Ting, after experimenting with rubber latex for three years, finally developed the right formula for producing a foam rubber that he claims compares very favorably with the imported products. Some months ago he set up a factory in Ipoh, equipped with machinery and molds of his own design, which uses 900 to 1,000 pounds of latex daily, which he obtains from smallholders paying No. 1 RSS prices. The foam rubber made from locally produced latex is considerably cheaper than the imported product, which must pay high tariff and freight charges. Many orders from various parts of the country are said to have been received already, and the government has also placed trial orders for mattresses.

BURMA

From Rangoon, Burma, comes the report of Burmese interest in possible trade agreements with Soviet Russia and Communist China. It seems that Burma would like to exchange rice and rubber for heavy machinery.

New Machinery

Syphon Elbow



Type J Joint with Syphon Elbow and Assembly Plate

THE development of a hinged syphon elbow and of a special assembly plate for the Type J rotary pressure joint[1] has been announced by the Johnson Corp., Three Rivers, Mich.

The elbow, intended to eliminate the need of a curved syphon pipe, is available with threaded ends for accommodating attached pipes. The weight of the first pipe, as it is inserted into the roll or drum, causes the elbow to close, enabling the stainless-steel seat to create a closed line that is reportedly leak- and pressure-proof.

The recently redesigned pressure joint is now made with a special assembly plate which serves to hold the internal parts of the joint in position when the head is removed. This feature permits removal of the syphon pipe without disturbing the joint proper or the steam inlet connection. All Type J joints, one inch and larger, are designed to permit the addition of these assembly plates.

[1] See our Jan., 1954, issue, p. 528, for description of the joint.

Electrical Switch Enclosures

LEAD-PLATED, sheet-steel enclosures for safety switches and circuit breakers are being manufactured by General Electric Co., Plainville, Conn., for outdoor use and other special applications where cast-iron enclosures had previously been employed. Plants which have humid, dust-laden, and corrosive atmospheres should find the new product very useful because of its corrosive-resistant lead coating. Another advantage of the enclosure is their light weight, making handling and installation much easier than with the cast-iron types.

Heavy-Duty Extruders

TWO new heavy-duty extruders, designed to handle the discharge from Banbury mixers, have been introduced by Farrel-Birmingham Co., Inc., Ansonia, Conn. The 15-inch extruder is recommended for use with the size 11 Banbury mixer, and the 20-inch extruder is for use with the size 27 Banbury (approximately twice the batch capacity of the size 11). Both machines are reportedly capable of accommodating the full output from the mixers on short-cycle operations of 1½-2½ minutes. Slabs approximating 50 and 60 inches in width can be discharged from the 15- and 20-inch extruders, respectively.

In addition to the short-cycle operation, the smaller machine can be adapted to longer cycles during which the discharge from two size 11 Banburys can be handled. This set-up permits production at a rate of 10,000-18,000 pounds per hour. With one mixer feeding, the Banbury discharges directly into the extruder hopper.

Operation of the extruder is entirely automatic. Flow of ma-

F-B 15-Inch Extruder for Use with Banbury Mixer

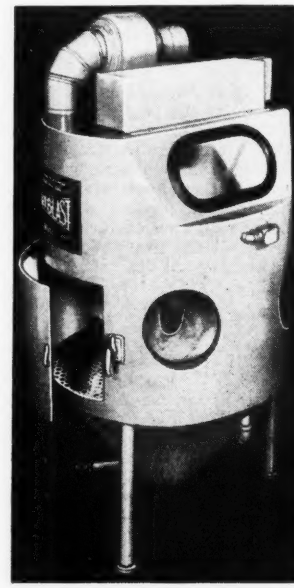
terial through the extruder chamber has been accelerated and simplified, and the plasticity of the stock worked by the screw in a single pass is more uniform than that of milled stock, according to the company. Adequate cooling of the discharge stock is provided in order to maintain the same temperature at both the Banbury and extruder outlets. A design innovation contained on the new units is a retractable cone, operated by an air-hydraulic system, which is intended to facilitate clean-out. Other features include a water-cooled cone nose and an electric eye in the feed hopper which actuates a clutch to stop the extruder when the hopper becomes empty.

Metal Cleaning Unit

A BENCH-MODEL Jet Blast cleaning unit, made by R. W. Renton & Co., Cleveland, O., is available for removing rust, scale, and other foreign deposits from dies, molds, tools, and other precision articles. This operation, says the company, is done without any altering of the dimensions of the articles.

Smaller in size than previous Jet Blast units, the new machine stands slightly over 3½ feet high and weighs 155 pounds. It functions by use of an abrasive-containing liquid slurry which is blasted at the part to be cleaned by means of a high-velocity air stream. Variations of abrasives permit wide use of this cleaning machine.

Portable because of its compact size, the unit can employ one or two blast guns discharging 28-42 cubic feet of air per minute at 85-100 psi. Other specifications include: liquid capacity, two gallons; abrasive capacity, 13 pounds; and motor size, 1/16-hp.

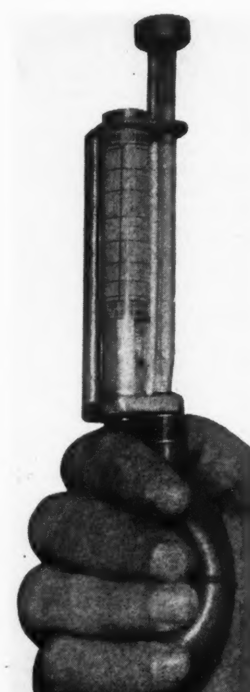


Bench Model Jet Blast Machine

SO_2 Gas Detector

A PORTABLE sulphur dioxide gas detector, capable of quickly determining atmospheric gas concentrations of 0-50 parts per million with exceptional accuracy, has been developed by Mine Safety Appliances Co., Pittsburgh, Pa. Supplied in a leather carrying case in which are contained materials necessary for making 12 separate tests, the instrument translates the amount of decoloration of a contained reagent into meaningful gas concentration figures.

To use, the reagent is made by mixing two supplied chemicals and placing the mixture in the chambers of the detector. An air sample is drawn into the instrument by means of an aspirator bulb. Contained SO_2 decolors the granules of the reagent from blue to white, with the length of the white stain (measured from the sample inlet) reportedly proportional to the gas concentration in the sample. An integral sliding chart converts the reading into % SO_2.



Sulphur Dioxide Gas Detector

New Materials

Modified Fatty Acids

THE commercial availability of three new, structurally modified fatty acids has been announced by Emery Industries, Inc., Carew Tower, Cincinnati 2, O. Described in the company's Technical Bulletin No. 50, these acids possess the color and heat stability associated with high-quality stearic and palmitic acids, yet have the consistency and solubility characteristics of distilled tallow fatty acids. Two of the products are practically saturated (2 to 4 I.V.) C_{16} and C_{18} monocarboxylic acids.

The following table contains some of the typical characteristics given for the modified acids.

	994-R	995-R	996-R
Titer, °C	44	44	45
Iodine value, Wijs	34.5	4.0	2.0
Free fatty acid (as oleic), %	98.2	96.0	98.0
Total fatty acid (as oleic), %	102.5	102.3	104.5
Unsaponifiable matter, %	1.5	1.5	1.0
Polyunsaturated acid content, %	0.5	0.0	0.0
Color, Lovibond (5¼ inch cell)	2.0Y/1.0R	2.0Y/6.5R	1.1Y/0.5R

Other features of these products include the relatively high solubility of their potassium soaps (16% real soap solutions are clear and completely fluid) and the oustanding gelling properties of their aluminum soaps (worked stability of lubricating greases made from these soaps comparable to that of high-gel stearates).

Phthalate-Type Plasticizer

PITTSBURGH PX-114 (decyl butyl phthalate), a new low-cost, highly compatible plasticizer for vinyls, has been developed by Pittsburgh Coke & Chemical Co., Pittsburgh, Pa. The new product is said to be a primary plasticizer comparable to DOP (dioctyl phthalate) in low-temperature flexibility, mechanical properties, and permanence qualities. While somewhat more volatile than DOP, PX-114 is reported to have good heat and light stability and to require no special stabilization.

The new plasticizer is claimed to be suitable for reducing formulating costs without affecting the quality and performance properties of many types of vinyl products. Suitable applications include garden hose, welting, gasketing, clotheslines, inflatable toys, sheeting, and others. Plastisols and organisols containing the product may be used for the manufacture of all types of slush or dip molded items and for dispersion coatings.

Epoxy Plasticizer — Drapex 3.2

VINYL plasticizer Drapex 3.2, a light-colored epoxy compound said to impart low-temperature flexibility to products in which it is used, is now commercially available from Argus Chemical Laboratory, 633 Court St., Brooklyn 31, N. Y. The new material is represented as having high molecular weight, extremely low volatility (one-half that of dioctyl phthalate), low viscosity, and excellent wetting properties. Incorporated into vinyls, this plasticizer reportedly imparts better low-temperature characteristics than does dioctyl adipate and is claimed to have good heat and light stability and freedom from tack development upon aging. Specific gravity for the linearly structured compound is given as 0.905.

Butadiene-Styrene Latex — Polyco 556

A HIGH styrene-butadiene copolymer latex that is stable to freeze-thaw cycles is available from American Polymer Corp., Peabody, Mass. Designated Polyco 556, this new material also possesses unusual mass flow (rheological) properties and low foaming characteristics, according to the company's technical data sheet P-29 Supplement.

Rated as satisfactory in alkyd compatibility, the latex is represented as having the following physical properties: solids content, 47-48%; weight, 8.5 pounds per gallon; pH value, 9.8-10.2; surface tension, 33.5 dynes per centimeter; and viscosity, greater than 50 centipoises. The material was specifically developed for use as a pigment binder in paint, but its properties suggest possible applications in other fields.

Thermoplastic Resin — "Cycolac"

"CYCOLAC," a styrene-type thermoplastic resin of one-material composition, has been introduced by Marbon Corp., Gary, Ind. Recommended for fabrication into piping, fittings, signs, fixtures, etc., the new material can be milled, calendered, extruded, injection molded, or post-formed into a wide variety of products.

In finished articles, "Cycolac" is a hard, light, tough, glossy substance that can be solvent-welded or machined if desired. Such articles are represented as possessing excellent resistance to impact, high heat-distortion, and low brittle-point temperatures, good resistance to chemicals, and outstanding electrical properties.

The resin powder can be supplied in bright colors and is soluble in selected solvents for potential coating applications.

Breathable Vinyl Upholstery

PRODUCTION of a new line of upholstery material containing multiple small holes that permit the passage of air has been begun by United States Rubber Co., Rockefeller Center, New York 20, N. Y. Called Breathable Naugahyde, the new vinyl product is fabricated on newly developed machinery which incorporates the breathable, porous feature into the basic construction of the material.

Almost two years of testing on the driver's seats of some 20 buses have reportedly demonstrated the comfort of the new material for covering foam rubber cushioning and deep springs.

The Drexel Furniture Co., moreover, recently introduced a line of home furniture which uses this upholstery material.

Available in four colors in a variety of textures and patterns, Breathable Naugahyde is supplied in rolls 54 inches wide and 30 yards long.

In appearance, the sheeting has a slip-finish corrugated surface and a strong cotton fabric backing. Passage of air through the upholstery takes place between the fabric threads in the valleys of the surface corrugations.

Thiomalic Acid

THIOMALIC acid, a polyfunctional compound that undergoes the reactions typical of both mercaptans and di-carboxylic acids, is available from Evans Chemetics, Inc., New York, N. Y. Reportedly effective as a color-reducer in crepe rubber and as a tackifier in GR-S rubber, the material can be obtained in quantities from one pound to many tons.

Assaying 97% pure (minimum) with a maximum ash content of 0.5%, the acid is represented as having a melting point of 150° C. It is supplied in the form of an off-white powder with a solubility of 0.5-gram per cubic centimeter in both water (at 40° C.) and ethanol (at 25° C.). The product is insoluble in benzene.

Thermoplastic Resins — Advaresins CXF and KF

THE development of two new ketone-type thermoplastic resins, Advaresins CXF and KF, designed for incorporation into rubber and plastic compounds to increase the adhesive properties of the product, has been announced by Advance Solvents & Chemical Corp., New York, N. Y. Soluble in most plasticizers, including the phthalate types, the new materials are compatible with natural, chlorinated, neoprene, and nitrile rubbers; and vinyl copolymers, vinyl chloride polymers, ureas, melamines, and other plastics, according to the company.

Advaresin CXF, a practically colorless condensed ketone resin, has reportedly been used as an additive to improve the adhesion of cellulose and vinyl finishes, gasoline resistant finishes, specialty inks, and neoprene- and nitrile-base rubber cements. Specifications given for the transparent resin include: acidity, neutral; specific gravity, 1.1-1.2; melting range, 85-90° C.; and solubility, infinite in alcohols, esters, and ketones, but insoluble in aliphatic hydrocarbons. Suggested formulations using CXF call for its addition in quantities ranging from 20-35% of resin solids.

Advaresin KF, straw-colored ketone formaldehyde resin, is recommended by the company for use as an anti-blocking agent in polyvinyl acetate inks and as an extender in lacquers and shellac. The transparent material has a specific gravity of 1.202 and a melting range of 115-120° C. It is said to be odorless and practically neutral in acid content and has a viscosity of 0.25-poise (50% solution in alcohol at 25° C.). In addition to being soluble in alcohols, ketones, esters, and glycols, KF is also quite soluble in aromatic hydrocarbons.

New Goods

Surface Design of Uncured Camelback (*Left*) and Finished Tread after Curing

Basket-Weave Camelback

A NEW type of camelback retread rubber on the surface of which is pressed a deep-cut basket-weave design is being manufactured by United States Rubber Co., Rockefeller Center, New York 20, N. Y. Tires retreaded with this rubber reportedly contain thousands of additional gripping edges that provide motorists with traction and skid protection equal to or better than that for new tires.

The "pre-de-skidding" process by which the new camelback is made employs a special wheel containing a series of heated teeth to cut permanently the design into the uncured rubber. The product, as shipped to the retreader, can be used with any tread design, requires no new equipment or special handling, and is uniform in service, appearance, and performance, according to the rubber company. Tires retreaded with the new material, as compared to tires which use conventional, smooth-surface camelback, are said to have as much as 30% increased traction ability without any reduction in the mileage life.

Tires with Craze-Resistant Sidewalls

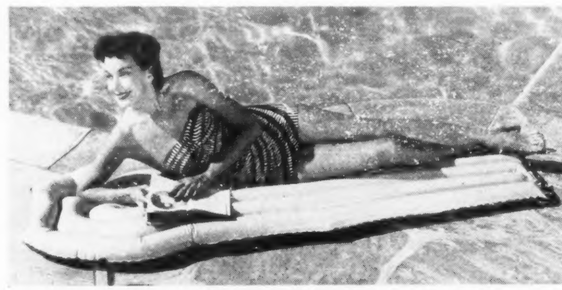
TIRES that contain a newly developed pigment which reportedly permits retention of the "new tire" appearance for the life of the original tread mileage are now being produced by Firestone Tire & Rubber Co., Akron, O.

Development of the new chemical ingredient was originally intended to solve the problem of rapid weather checking, crack-

Section of Age-Resistant Tire, Specially Built with Half-and-Half Sidewall, after 23,000 Miles on California Test Car

ing, and discoloration of white sidewalls in areas having a high concentration of ozone and smog in the atmosphere. Use of this chemical, however, has now been extended to include all Firestone tires of both black and white sidewalls. In this application, tests have indicated that as much as 60% increase in the resistance of tires to crazing is obtainable.

The special pigment credited with making possible this performance is described as having a higher-than-normal melting point. Compounded with the rubber and other chemicals used in tire manufacture, the material functions by continually providing a film-like protective coating over the sidewall and other parts of the tire, according to the manufacturer. The color and the appearance of tires, especially those with white sidewalls, are in this way retained for the original life of the tire.



New Koroseal Air Mat

Koroseal Air Mat

A NEW air mat, for sun bathing, surf riding, or camping, is being manufactured by The B. F. Goodrich Co., Akron, O., as a companion to the company's play-pond line. Made of Koroseal, the new product is designed after the type of mattresses used by the Armed Services.

The unit is 74 inches long by 24-33 inches wide and is made up of six tubes with two separate air chambers and two valves for inflation and deflation. With seams electronically sealed, the air mat will reportedly stand greater than ordinary pressures, thus making it quite safe for most purposes.

Solvent-Handling Hose

A NEW solvent-handling hose with high resistance to ketones, esters, and alcohols of petroleum is being marketed by Hewitt-Robins Inc., Stamford, Conn. The product uses a Thiokol tube and a heavy-duty tank-car type of construction which suggests service in suction as well as discharge applications.

Available in single 50-foot lengths in three diameters of two, 2½, and three inches, the units are recommended for use in the metal-working and paint and varnish fields.

Food Conveyor Belt

A NEW, improved canner's conveyor belt, for use in handling all kinds of food, has been developed by Goodyear Tire & Rubber Co., Akron. The unit is said to retain the basic characteristics of not imparting taste or odor to products and of being stain, acid, and mildew resistant, while providing additional advantages that increase the life of the belt.

Most of the new properties of this specialty belt are the result of a new rubber cover. Laboratory tests show the new product to give increases of 20-35% in abrasion resistance, 12% in tear resistance, 25% in elasticity, and 40% (white and tan colors) or 100% (black covers) in tensile strength.

Silicone Enameled Magnet Wire

SINGLE and heavy-grade wires, insulated with silicone enamels and intended for use in electrical equipment operating at "hottest spot" temperatures of at least 130° C., have been produced by Anaconda Wire & Cable Co., New York, N. Y. Dielectric strength of the coated magnet wire is given as 1,500

(Continued on page 833)

Editor's Book Table

BOOK REVIEWS

"Rubber Red Book." 1953-54 Edition, Ninth Issue. Published by *Rubber Age*, 250 W. 57th St., New York, 19. Cloth, 6 by 9 inches, 1,198 pages. Price, $10.

This series continues to grow in size; the new edition shows an increase in total number of pages, including advertisements, of 84 over the eighth issue. The general format and appearance are unchanged, although each section has been revised and brought up to date. Innovations in this edition include a special section devoted to export agents and the inclusion of the full names of company officers and executives in the alphabetic listing of rubber manufacturers.

The directory is divided into sections covering rubber manufacturers in the United States and Canada; rubber machinery and equipment; laboratory and testing equipment; accessories and fittings; rubber chemicals and compounding materials; fabrics and textiles; natural rubber and related materials; synthetic rubbers and other rubber-like materials; reclaimed rubber; scrap rubber and plastics; latex and related materials; miscellaneous products and services; consulting technologists; sales agents and branch offices; export agents; educational courses in rubber chemistry and technology; trade and technical organizations; technical journals; who's who in the rubber industry; and both subject and advertiser indices.

"Handbook of Chemistry and Physics." Thirty-fifth Edition. Charles D. Hodgman, Editor-in-Chief. Chemical Rubber Publishing Co., 2310 Superior Ave., N.E., Cleveland 14, O. Cloth, 4½ by 7¼ inches, 3,184 pages.

Newly revised and brought up to date, this new issue of the Handbook shows an increase of 214 pages over the preceding edition. Major changes in the subject matter include the complete revision of the table of isotopes; a new table on thermal neutron cross-sections; recalculation of Van der Waal's constants into more useful form; revision and expansion of the table on quantitative analysis by means of organic reagents; a new table on mutual solubility of organic compounds; and a new table on the thermodynamic values of compounds. The general appearance and format of the book remain the same, with the contents divided into five sections, as follows: mathematical tables; properties and physical constants; general chemical tables; physics data; and quantities and units.

"Toxic Solvents." Ethel Browning. Published by Edward Arnold & Co., London, England; available from St. Martin's Press, 103 Park Ave., New York 17, N. Y. Cloth, 5½ by 8½ inches, 176 pages. Price, $4.

This book is an outgrowth of a report originally prepared by Dr. Browning in 1937 for the British Government, and since in great demand throughout the world. Pending the publication of a revised issue of this report, the current volume is designed to fill the need of a critical review of published literature on the toxicity of industrial solvents, written in language sufficiently intelligible and concise for practical use.

The text includes an explanation of the physical and chemical characteristics of organic solvents; a description of the physiological properties of these solvents; a classified listing of all major solvents with their properties, uses, toxic effects, and treatments; a glossary of simple medical terms used in the text; and a subject index. The book should be an active reference work for everyone concerned with safe and efficient plant operation in the rubber, plastics, rayon, soap, protective coatings, and chemical process industries.

NEW PUBLICATIONS

"How You Can Lay a Rubber Tile Floor." The Rubber Manufacturers Association, Inc., 444 Madison Ave., New York 22, N. Y. 8 pages. This guide on the laying of rubber tile floor includes a chart on which to diagram the room and lay out the floor pattern, instructions on preparing the sub-floor, installing the tile, and maintaining the finished floor.

"Thiokol Synthetic Rubbers." Thiokol Chemical Corp., Trenton, N. J. 4 pages. Typical properties and successful applications of these products are described in this bulletin.

"Sterling SO for Dimensional Stability of Uncured Butyl Tubes." C. W. Gnerre. Cabot Technical Service Laboratory Bulletin No. GD-7. Godfrey L. Cabot, Inc., 77 Franklin St., Boston 10, Mass. 6 pages. A comparison of the physical properties resulting from the compounding of two kinds of Butyl rubber with Sterling SO, two types of competitive FEF blacks, and a mixture of EPC and FEF blacks is reported. Included is a description of the "Extrusion Sag Test" and its results which show the advantage of the Cabot material over the other materials used.

"Extending Buna N with Sterling MT and Plasticizer." T. D. Bolt. Technical Service Laboratory Bulletin No. GD-8. Godfrey L. Cabot, Inc. 3 pages. This report illustrates the results that can be obtained when nitrile rubbers are extended with high loading of Sterling MT in conjunction with Cabol 100 or Cabflex DIOP plasticizer.

"B. F. Goodrich Hot Material Conveyor Belts." Catalog Section 2400. The B. F. Goodrich Co., Akron, O. 2 pages. This catalog insert describes and illustrates the construction and working condition limitations of these units, which are made with rayon fabric, cord, and glass-fabric reinforcement.

"B. F. Goodrich Elevator Belting." 26 pages. This illustrated engineering handbook covers types of belt bucket elevators, factors important in belt selection, procedures for engineering the correct belt, and construction features of the company's products.

Publications of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

"Practical Neoprene Compounds for Use in Highly Competitive Products." BL-249. 16 pages. Giving typical formulations of hose, extruded goods, and molded goods, this report describes how neoprene products comparable in cost to those made from non-oil resistant elastomers can be manufactured. Of special interest is the use in these capacities of a new neoprene rubber, Type WHV, which is a high-viscosity grade of a non-sulfur modified type recommended to eliminate processing difficulties due to the excessive softness of highly extended stocks.

"Teflon (Tetrafluoroethylene Resin) Finishes." Bulletin No. 1. 12 pages. Low viscosity, water-dispersed finishes are described in this booklet, according to their anti-sticking, heat, corrosion, and abrasion resistant properties; recommended surfaces to which they can be successfully applied; preparation of the surface; methods of application of the finishes; and data on fusing operations.

"Rubber Chemicals: The Non-Staining and Non-Discoloring Polygard Stabilized GR-S Polymers." Compounding Research Report No. 28. C. W. Lawson and F. L. Holbrook. Naugatuck Chemical Division of United States Rubber Co., Naugatuck, Conn. 16 pages. Described in this bulletin are non-staining and non-discoloring Polygard stabilized GR-S polymers for wire, low-temperature service, sponge, tires, soling, sundries, and pressure-sensitive tapes. Also covered are stabilized cross-linked polymers, designed to facilitate easy processing of the compound.

Publications of Monsanto Chemical Co., St. Louis, Mo.

"Di (n-Octyl, n-Decyl) Phthalate." Technical Bulletin No. 0-109. 8 pages.

"Dioctyl Adipate." Technical Bulletin No. 0-106. 8 pages. These primary plasticizers, commonly called DNODP and DOA, respectively, are outlined as to physical and chemical properties, specifications, recommended uses, and test information on plastics in which they have been compounded.

Publications of Allied Chemical & Dye Corp., New York, N. Y.:

"Announcing Ethylene Oxide, Ethylene Glycol, and Diethylene Glycol." 33 pages. A full description of each of these chemicals, production of which will soon begin, is given, including uses, chemical and physical properties (with chart and graphs), analytical procedures, handling and storage features, and safety precautions.

"A-C Polyethylene as a Lubricant in Vinyl Processing." 7 pages. Presented in this bulletin are data which compare the lubricating action and other properties of A-C polyethylene with some common release agents now used in the processing of vinyl sheeting and film.

300 TON ERIE
Hydraulic Presses

Versatility in Rubber Molding

IN one of the Rubber Industry's largest plants, these 10 Erie 300 Ton Hydraulic Presses are molding a multitude of rubber products. Each Erie press shown here has four 3 ton pushback cylinders. Main rams are ground from chilled iron. Pushdown rams are of stainless steel. All glands and guides are bronze. Each press has two 6 inch openings and 24 inch by 24 inch platens. Nearly a half-century of engineering "know how" in designing Erie Foundry Company hydraulic presses is matched by unexcelled craftsmanship in producing this equipment for the rubber and plastics industry. Let Erie Foundry Company Engineers consult with you on your hydraulic press problems. Bulletin 350 gives full details on Erie Foundry Company Hydraulic Presses. Write for it.

ERIE
FOUNDRY COMPANY
HYDRAULIC PRESSES

ERIE FOUNDRY COMPANY • *Erie, Pa., U.S.A.*

DETROIT • CHICAGO • INDIANAPOLIS • NEW ENGLAND
335 Curtis Building • 13 South Austin Blvd. • 2302 N. Meridian Street • G. V. Eads, Kent, Conn.

"Hycar Technical Newsletter." Vol. 3, No. 1. B. F. Goodrich Chemical Co., Rose Bldg., Cleveland 15, O. 4 pages. This bulletin covers the subjects of the evaluation of white reinforcing agents and the effect of shelf aging on the cure of Hycar 4021 compounds.

"Hycar Technical Newsletter." Vol. 3, No. 2. 4 pages. Contained in this publication are discussions on "Hycar 1041—An Improved High Nitrile Polymer" and "Sulphur Dispersion in Hycar Recipes."

Publications of Dow Corning Corp., Midland, Mich.:

"Silastic Newsletter." Vol. I, No. 6. 6 pages. Contained in this issue are items on the continuous calendering of thin reinforced Silastic sheets, resistance of Silastic to hydraulic oils, fabrication of Silastic covered rolls, and the use of Silastic in medical applications.

"Silicone News." No. 4. 2 pages. The application of some silicone products to damping, toggle switch boot seals, and the production of laminates are contained in this bulletin.

Publications of the Reconstruction Finance Corp., Office of Synthetic Rubber, Washington 25, D. C.

"Specifications for GR-S 1006." "Specifications for GR-S 1602." 2-15-54. 1 page each. These inserts describe the physical properties of the respective polymers and are intended for inclusion in "Specifications for Government Synthetic Rubbers—Revised Edition, October 1, 1952."

"Tlargi Yearbook, 1954." Vol. XIII. The Los Angeles Rubber Group, Inc., Statler Hotel, Los Angeles 17, Calif. 96 pages. This attractive, illustrated yearbook includes officers, directors, and committees of the Group; achievements of Tlargi Rubber Technology Foundation; descriptions of the Basic Rubber Technology Courses given at the University of Southern California; 1953 social activities of the Group; membership list; suppliers to the rubber industry; a listing of Pacific Coast rubber manufacturers with their principal products; and a technical features section in which is contained much information on rubber.

"Herstellung von Gummifaden aus Latex (Production of Rubber Thread from Latex). Abstracts of Patents and Review of Literature (1953)." Rubber Stichting, Delft, Holland. Communication No. 228. Mimeographed, German, 46 pages. Abstracts of 208 patents relating to the production of latex thread, and in a few special cases to the uses of latex thread, are listed, including United States, Belgian, German, British, French, Netherlands, Austrian, and Swiss patents available in the Netherlands up to February, 1953. As to the literature, mention is made of 28 books and special articles published in various countries, in which latex thread manufacture is discussed, or patents are reviewed.

"R/M Super-Power V-Belts." Bulletin No. 6628. Raybestos-Manhattan, Inc., Passaic, N. J. 4 pages. A complete list of sizes and new belt numbers applicable to these V-belts, for which are claimed a 40% increase in horsepower capacity over standard belts, resistance to shock loads, and length stability, is contained in this catalog insert.

"Heaters." Dravo Corp., Pittsburgh, Pa. 14 pages. This folder describes and illustrates a variety of successful applications of conventional warm-air space heaters to industrial process drying. One such case study, on the curing of latex rubber masks produced by a mold dipping procedure, covers the Bayshore Industries installation at Elkton, Md.

"The Inside Story of the Tire." Seiberling Rubber Co., Akron, O. 12 pages. This 11- by 17-inch publication consists of a series of nine excellently prepared and presented articles on how a tire is made. Written for the average plant employe, the descriptive material is profusely illustrated. The series first appeared in the company's house organ, *"The Seibeneer,"* and has been reprinted for distribution in this form.

"The Future of Rubber." John T. Blake. Simplex Wire & Cable Co., Cambridge, Mass. 16 pages. This address, previously published in India RUBBER WORLD,[1] and *Chemical & Engineering News*, was given by Dr. Blake on the occasion of his being awarded the 1953 Charles Goodyear Gold Medal for "outstanding research in the rubber industry."

[1] Nov., 1953, p. 222.

BIBLIOGRAPHY

Crystallization and Tensile Strength of Vulcanized Natural Rubber Compounds. S. H. Morrell, J. Stern, *Trans. Inst. Rubber Ind.*, Oct., 1952, p. 269.

Heat Sensitization of Latex by the Zinc Salt of Mercaptobenzimidazole. R. Delattre, *Rubber Chem. Tech.*, July-Sept., 1952, p. 621.

Interpretive Analyses of Urea-Formaldehyde Resins. P. P. Grad, *Paint, Oil, Chem. Rev.*, Dec. 18, 1952, p. 20.

Cables and Chemistry. *Can. Chem. Processing*, Oct., 1952, p. 82.

Resin Forming Reactions of Furfural and Phenol. L. H. Brown, *Ind. Eng. Chem.*, Nov., 1952, p. 2673.

Urea-Formaldehyde and Melamine-Formaldehyde Condensations. H. P. Wohnsiedler, *Ind. Eng. Chem.*, Nov., 1952, p. 2679.

Chloromethylation of Polystyrene. G. D. Jones, *Ind. Eng. Chem.*, Nov. 1952, p. 2686.

Accelerated and Outdoor Weathering of Colored Vinyl Films. F. G. Clark, *Ind. Eng. Chem.*, Nov., 1952, p. 2697.

The Crystallization of Vulcanized Natural Rubber at Low Temperatures. E. W. Russell, *Rubber Chem. Tech.*, July-Sept., 1952, p. 397.

Stress-Temperature Studies of Transitions in Rubbers. R. S. Witte, R. L. Anthony, *Rubber Chem. Tech.*, July-Sept., 1952, p. 468.

The Application of Polarized Infrared Radiation to Problems in Molecular Structure. G. B. B. M. Sutherland, A. V. Jones, *Rubber Chem. Tech.*, July-Sept., 1952, p. 480.

Viscoelasticity of Rubber. R. B. Blizard, *Rubber Chem. Tech.*, July-Sept., 1952, p. 490.

Chemical Constitution and Deactivating Effect. J. le Foll, *Rubber Chem. Tech.*, July-Sept., 1952, p. 549.

Kinetic Analysis of Organic Halides. IV. G. Salomon, C. Koningsberger, *Rubber Chem. Tech.*, July-Sept., 1952, p. 573.

Evaluating Dynamic Fatigue of Adhesion of Tire Cords to Rubber Stocks. W. J. Lyons, *Rubber Chem. Tech.*, July-Sept., 1952, p. 669.

Quantitative Determination of Natural Rubber Hydrocarbon by Refractive Index Measurements. R. J. Fanning, N. Bekkedahl, *Rubber Chem. Tech.*, July-Sept., 1952, p. 680.

Rubber in Railway Bogie Design. F. N. Pickett, *Rubber Age (London)*, Oct., 1952, p. 362.

Fire Resistance. "Pelham," *Rubber Age (London)*, Oct., 1952, p. 364.

Getting the Most out of Neoprene. H. J. Lanning, *Rubber Age (London) Supplement*, Oct., 1952, p. 14.

Neoprene—A General Survey. J. F. E. Ruffell, *Rubber Age (London) Supplement*, Oct., 1952, p. 18.

Advances in Styrene. J. F. Clark, *Rubber Age (London) Supplement*, Oct., 1952, p. 19.

Developments in Plastics for the Rubber Industry. *Rubber Age (London) Supplement*, Oct., 1952, p. 10.

Some Notes by Dunlop Rubber Co. on Synthetic Materials. *Rubber Age (London) Supplement*, Oct., 1952, p. 11.

Synthetic Rubbers from Canada. *Rubber Age (London) Supplement*, Oct., 1952, p. 20.

The Production and Manipulation of Vinyl Plastics in Dry Powder Form. S. J. Skinner, *Rubber Age (London) Supplement*, Oct., 1952, p. 26.

Polystyrene—A Versatile Molding Material. D. R. Crabtree, *Rubber Age (London) Supplement*, Oct., 1952, p. 30.

Synthetics Serve the Services. W. J. Edwards, *Rubber Age (London) Supplement*, Oct., 1952, p. 32.

PVC for Conveyor Belting, Long-Playing Records, Paints. *Rubber Age (London) Supplement*, Oct., 1952, p. 34.

Hostaflon—A New Material. *Rubber Age (London) Supplement*, Oct., 1952, p. 35.

Magnet Wire

(*Continued from page 828*)

volts per mil.

The new product is reported to have good abrasion resistance, good adhesion to conductor, and immunity to common solvents. Smooth and tough, the coating will not crack when subjected to temperatures as low as —65° C., according to the company. Color of the coating, which can be removed by "chemical strippers," is reddish-brown or darker. When this wire is used in windings, best results will be obtained in conjunction with silicone treated glass fiber insulators and silicone varnishes.

MARKET REVIEWS

RUBBER

ACTIVITY in both the rubber spot and futures markets continued light during the period from January 16 to February 15. Offerings of physical rubber ranged from moderate to heavy throughout the period, but factories were inclined to purchase on the price downswings while displaying a wait-and-see attitude. Prices moved through a relatively narrow range in view of the lack of buying demand.

New York Spot Market
Week-End Closing Prices

	Nov. 28	Dec. 26	Jan. 23	Jan. 30	Feb. 6	Feb. 13
R. S. S., #1	21.25	20.63	20.13	20.25	20.25	20.38
2	20.38	20.25	19.63	19.88	19.88	20.00
3	19.38	19.88	19.38	19.63	19.63	19.75
Latex Crepe						
#1 Thick	26.38	25.88	24.50	24.38	24.38	24.13
Thin	23.38	22.88	22.63	22.25	22.25	22.25
#3 Amber Blankets	17.38	18.00	17.50	17.38	17.50	17.63
Thin Brown Crepe	16.63	17.50	16.50	16.63	16.63	16.63
Flat Bark	15.50	16.00	15.25	15.25	15.25	15.13

No. 1 Ribbed Smoked Sheets started the period at a high of 20.38¢, dropped back to a low of 19.75¢ on January 25 and 26, rose again to 20.38¢ on February 11 and 12, and closed at 20.25¢ on February 15. Other grades showed corresponding price movements, although some narrowing of the differentials for #2 and #3 R.S.S. grades took place. January monthly average spot prices for certain grades were as follows: #1 R.S.S., 20.35¢; #3 R.S.S., 19.63¢; #3 Amber Blankets, 17.69¢; and Flat Bark, 15.56¢.

Commodity Exchange
Week-End Closing Prices

Futures	Nov. 28	Dec. 26	Jan. 23	Jan. 30	Feb. 6	Feb. 13
May	21.30	20.25	20.05	20.15	20.05	20.15
July	21.30	20.25	20.05	20.15	20.05	20.15
Sept.	21.35	20.30	20.05	20.20	20.05	20.15
Dec.	21.39	20.35	20.05	20.15	20.05	20.15
Mar. '55		20.35	20.05	20.15	20.05	20.15
Total weekly sales, tons	2,150	230	1,080	2,640	610	620

May futures started the period at 20.25¢, rose to a high of 20.28¢ on January 19, fell back to a low of 19.55¢ on January 25 and 26, then recovered to fluctuate irregularly and close at 19.95¢ on February 15. Sales during the second half of January amounted to 3,720 tons, making a total for the month of 5,130 tons. Sales for the first half of February were 1,460 tons.

A list of prices for all currently available GR-S and GR-I polymers was issued by the Office of Synthetic Rubber, RFC, on February 1, as follows:

GR-S Polymers

Hot GR-S Non-Pigmented

	Price per Pound, ¢
Staining	
1000, 1004, 1007	23.00
1002, 1005, 1015, 1016, 1023	23.25
1021	24.00
Slightly Staining	
1001	23.00
1003	23.25
1014	23.50
Non-Staining	
1006, 1010, 1012, 1013	23.00
1009, 1011, 1019	23.25
1018, 1022	23.50

Hot GR-S Black Masterbatches

Staining	
1100	18.25
Slightly Staining	
1104	17.75

Cold GR-S Non-Pigmented

Staining	
1500, 1505	23.00
Slightly Staining	
1501	23.00
Non-Staining	
1502	23.00
1503, 1504	23.25

Cold GR-S Black Masterbatches

Staining	
1600, 1601, 1602	18.25

Cold GR-S Oil Masterbatches

100 parts GR-S, 25 parts oil	
1703	19.50
1704, 1705, 1706	19.25
100 parts GR-S, 37.5 parts oil	
1707, 1708	18.00
1709, 1710, 1711, 1712	17.75

Cold GR-S Oil Black Masterbatches

Staining	
1801	16.75

GR-I Polymers

GR-I, 15,* 17,* 18,* 25, 35, 50*	22.00

*Also available packed in coated cartons at the same price.

Latex

THE latex market during the period from January 16 to February 15 showed no important changes from the preceding month; prices were steady, and demand held at previous levels. As mentioned in the last market report, the high domestic inventories of natural latex appear to be in the hands of consumers. Most latex importers have reasonable inventories, but are nursing them rather carefully in expectation of a sharp reduction in imports for the next two or three months as the result of the wintering season in the producing areas. Indications are that this reduction in output will be quite substantial.

While domestic consumption of latex declined during the period from November to January, the outlook is for the automotive industry to be in high gear during the second quarter, with resultant high demand for latex foam. Coupled with increased demand from the upholstery industry, the foam manufacturer may well reach a new record in output this year. At the same time, demand for natural latex by foreign countries this year is expected to continue at the record 1953 level.

It has been reported that several of the larger estates in Malaya plan to shift some of their production to latex because of the less attractive price for dry rubber. If this shift takes place, the increase in latex supply should make itself felt some time around the end of the third quarter, at which time a softening in the latex price differential may take place.

Final November and preliminary December domestic statistics on natural and synthetic latices are given in the following table:

(All Figures in Long Tons, Dry Weight)

	Production	Imports	Consumption	Month-End Stocks
Natural latex				
Nov.	0	4,826	5,234	10,834
Dec.*	0	8,000	5,494	13,595
GR-S latices				
Nov.	3,705	10	3,510	4,533
Dec.*	3,890	10	3,533	4,881
Neoprene latex				
Nov.	754	0	553	1,064
Dec.*	636	0	534	1,072
Nitrile latices				
Nov.	352	0	244	743
Dec.*	490	0	277	768

* Preliminary.

A list of prices for the various types of GR-S latices currently available was issued by the Office of Synthetic Rubber, RFC, on February 1. These prices, for latex in tank-car quantities (10,000 gallons), follow:

GR-S Latex Prices

	Price per Pound, ¢
Hot Latices	
2000, 2001, 2006	21.50
2002	23.50
2003, 2004, 2005	25.00
Cold Latices	
2100, X-663	24.50
X-617, −734	22.50
X-667, −684, −710, −711, −753, −758	26.00

RECLAIMED RUBBER

SOME indications of a slight improvement in demand were noted in the reclaimed rubber market during the period from January 16 to February 15. Despite this change, reclaimers are still operating below capacity and can be expected to continue at these levels until a greater increase in demand becomes evident. The outlook for such an increase is uncertain in view of large tire manufacturers' inventories and the low natural rubber prices.

Final November and preliminary December statistics on the domestic reclaimed rubber industry are now available. November figures, in long tons, are: production, 21,191; imports, 132; consumption, 19,638; exports, 1,086; and month-end stocks, 31,226. Preliminary figures, in long tons, for December follow: production 21,194; imports, 124; consumption, 19,304; exports, 955; and month-end stocks, 32,899.

There were two changes in reclaim prices during the period: red tube stocks went to 21¢ a pound, a reduction of 3¼¢; and pure gum reclaim dropped 1¼¢ to 23¢ a pound. Current prices follow:

Reclaimed Rubber Prices

	Lb.
Whole tire: first line	$0.10
Fourth line	.0875
Inner tube: black	.15
Red	.21
Butyl	.125
Pure gum, light colored	.23
Mechanical, light colored	.135

The above list includes those items or classes only that determine the price basis of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims in each general group separately featuring characteristic properties of quality, workability, and gravity at special prices.

SCRAP RUBBER

SCRAP rubber market conditions continued on the quiet side during the period from January 16 to February 15. Orders for mixed auto tires for February delivery were said to be below January levels. One reclaimer specified a minimum of 40% truck and bus tires in each shipment, but not much difficulty was expected to be encountered in filling the order.

Fair business was done in black passenger tubes which rose from 4.00 to 4.50 and 4.25¢ per pound, respectively, at Akron and in the East. Red passenger tubes were

easier, falling off to 9.50¢ per pound after having been quoted previously at 9.75¢ in the East and 10¢ in Akron. There was little activity reported in other tire and tube scrap grades.

Following are dealers' selling prices for scrap rubber, in carload lots, delivered to mills at the points indicated:

	Eastern Points	Akron, O.
	(Per Net Ton)	
Mixed auto tires	$11.00	$12.00
S. A. G. auto tires	Nom.	Nom.
Truck tires	Nom.	15.00
Peelings, No. 1	40.00/41.00	40.00/42.00
2	Nom.	24.00
3	14.00/15.00	Nom.
	(¢ per Lb.)	
Auto tubes, mixed	2.50	2.50
Black	4.25	4.50
Red	9.50	9.50
Butyl	1.75	2.00

COTTON FABRICS

MOST wide industrial fabrics showed an easier price tone during the period from January 16 to February 15, despite a slow but steady upward trend in raw cotton costs. Underlying the easier price tone were the absence of any strong buying movements, and concessions and price shadings in the competitive market. Duck and chafer prices held firm in this period.

Most orders received by mills were for rush deliveries, pointing up the fact that consumer inventories of industrial fabrics are at very low levels. Most trade observers do not look for any heavy buying to develop for forward delivery, but believe that a steady demand will be noted during the next few months, with most contracts on a nearby-delivery basis. Under this setup, even a slight improvement in demand can be expected to firm prices quite rapidly and force buyers to make forward commitments to assure themselves of an adequate supply.

Cotton Fabrics

Drills		
59-inch 1.85-yd. ... *yd.*	$0.36 /	$0.365
2.25-yd.	.31 /	.315
Osnaburgs		
40-inch 2.11-yd. ... *yd.*	.2425 /	.245
3.65-yd.	.1575 /	.16
Ducks		
38-inch 1.78-yd. S. F. ... *yd.*	.35⅜	
2.00-yd. D. F.	.32	
51.5-inch, 1.35-yd. S. F.	.46⅝	
Hose and belting	.64	
Raincoat Fabrics		
Printcloth, 38½-inch, 64x60 *yd.*	.1375 /	.13⅞
Sheeting, 48-inch, 4.17-yd	.20	
52-inch, 3.85-yd	.22	
Chafer Fabrics		
14.30-oz./sq. yd. Pl. ... *lb.*	.71	
11.65-oz./sq. yd. S.	.63	
10.80-oz./sq. yd. S.	.6675	
8.9-oz./sq. yd. S.	.68	
Other Fabrics		
Headlining, 59-inch, 1.65-yd., 2-ply ... *yd.*	.475	
64-inch, 1.25-yd., 2-ply	.60⅛	
Sateens, 53-inch, 1.32-yd.	.55	
58-inch, 1.21-yd.	.595	

RAYON

RAYON statistics for 1953, issued by the Textile Economics Bureau, Inc., show that the total domestic production of high-tenacity yarn was 453,300,000 pounds, a new high exceeding the previous year's figure by 41,000,000 pounds. Total shipments of the yarn by domestic producers in 1953 were 445,200,000 pounds, and year-end stocks rose by 8,100,000 pounds. The average denier of 1953 high-tenacity yarn was 1,582, or barely under the 1952 average denier of 1,585.

Production of high-tenacity viscose yarn during the fourth quarter of last year fell off to 98,600,000 pounds from the totals of the preceding three quarters (117,000,000; 120,600,000; and 117,100,000 pounds, respectively). Average quarterly production in 1953 was 113,300,000 pounds, as compared with 103,100,000 pounds in 1952 and 83,200,000 pounds in 1951.

Shipments of rayon yarn in 1953 for use in tires and related products totaled 439,400,000 pounds, a new high, with the respective quarterly figures being 115,800,000; 117,700,000; 111,200,000; and 94,700,000 pounds. This yearly total exceeds by 36,400,000 pounds the figure set during the preceding year. The average denier of such 1953 shipments was 1,587, as compared with 1,589 in 1952.

There were no changes in rayon tire yarn and fabric prices during the period from January 16 to February 15.

Rayon Prices

Tire Yarns		
1100/480	$0.26	$0.63
1100/490		.62
1150/490		.62
1165/480		.63
1650/720		.61
1650/980		.61
1820/980		.61
2200/960		.60
2200/980		.60
2200/1466		.67
4400/2934		.63
Tire Fabrics		
1100/490/2		.72
1650/980/2	.659	.73
2200/980/2		.685

News about People

(*Continued from page 812*)

John L. Collyer, president of The B. F. Goodrich Co., was the subject of a long article in the January 15 issue of *Forbes* magazine. Tracing Mr. Collyer's life since Cornell University and his operations at the rubber company since becoming associated there, the publication lays much of the success currently being enjoyed by Goodrich at the feet of its president.

William L. Lhamon has been appointed manufacturers sales representative of The Firestone Tire & Rubber Co. in southern California. Mr. Lhaman has worked in many capacities for the company, in California, Utah, Oregon, and Idaho, including salesman, store manager, and district manager.

L. A. Jarvis has been named technical service representative of the calcium carbonate department, Wyandotte Chemicals Corp., Michigan Alkali Division, Wyandotte, Mich. He started his career in 1943 at Firestone Tire & Rubber Co., where he concentrated his efforts on product development and quality control. Joining Wyandotte in 1949 as a rubber and plastic research chemist, Mr. Jarvis was given the responsibility for pigment evaluation, application research, product development, and quality control on Purecal and other rubber chemicals. In his new post Mr. Jarvis will assist in customer service on technical problems, establish new applications for Purecal, and maintain proper quality specifications on calcium carbonate for use in related rubber and plastic products.

Estimated Pneumatic Casings, Tubes, Camelback Shipments, Production, Inventory, December, November, 1953; Year 1953, 1952

	Original Equipment	Replacement	Export	Total	Production	Inventory
Passenger Casings						
December, 1953	2,263,053	2,339,569	76,049	4,678,671	5,405,748	13,043,713
Change from previous month				+13.17%	−2.27%	+6.18%
November, 1953	1,875,109	2,184,584	74,641	4,134,334	5,531,385	12,284,070
Year 1953	33,105,694	45,798,234	808,599	79,712,527	81,454,605	13,043,713
1952	24,106,077	45,457,870	740,954	70,304,901	74,341,140	11,251,074
Truck and Bus Casings						
December, 1953	357,105	563,405	67,390	987,900	1,075,215	2,676,230
Change from previous month				+3.88%	+3.94%	+4.13%
November, 1953	345,924	544,737	60,345	951,006	1,034,469	2,570,026
Year 1953	4,843,415	9,326,230	734,463	14,904,108	14,695,839	2,676,230
1952	5,377,635	8,884,074	779,007	15,040,716	16,069,975	2,859,156
Total Automotive Casings						
December, 1953	2,620,158	2,902,974	143,439	5,666,571	6,480,963	15,719,943
Change from previous month				+11.43%	−1.29%	+5.83%
November, 1953	2,221,033	2,729,321	134,986	5,085,340	6,565,854	14,854,096
Year 1953	37,949,109	55,124,464	1,543,062	94,616,635	96,150,444	15,719,943
1952	29,483,712	54,341,944	1,519,961	85,345,617	90,411,115	14,110,230
Tractor—Implement Casings						
December, 1953	135,361	63,745	6,289	205,395	196,520	920,811
Change from previous month				+31.53%	+6.49%	+11.25%
November, 1953	97,918	53,906	4,339	156.163	184,535	828,596
Year 1953	2,395,105	1,367,018	67,604	3,829,727	3,756,232	921,811
1952	2,751,701	1,298,841	103,512	4,154,054	4,336,556	880,051
Passenger, Motorcycle, Truck and Bus Inner Tubes						
December, 1953	2,620,140	1,917,424	87,339	4,624,903	4,532,718	11,563,721
Change from previous month				+15.46%	−4.32%	−0.41%
November, 1953	2,222,050	1,707,942	75,699	4,005,691	4,737,511	11,611,122
Year 1953	37,972,083	36,110,467	882,371	74,964,921	74,514,328	11,563,721
1952	29,450,554	32,984,785	1,013,610	63,448,949	65,073,407	12,035,796
Camelback (Lbs.)						
December, 1953	—	26,612,704	1,092,332	27,705,036	26,278,438	25,864,392
Change from previous month	—			+1.91%	−1.31%	−4.15%
November, 1953	—	26,509,876	676,503	27,186,379	26,628,205	26,983,021
Year 1953	—	277,058,436	8,747,050	285,805,486	282,697,516	25,864,392
1952	—	256,511,360	5,911,360	262,422,720	262,584,000	22,173,760

NOTE: Cumulative data on this report include adjustments made in prior months.
SOURCE: The Rubber Manufacturers Association, Inc.

CLASSIFIED ADVERTISEMENTS

ALL CLASSIFIED ADVERTISING MUST BE PAID IN ADVANCE

Effective July 1, 1947

GENERAL RATES	SITUATIONS WANTED RATES	SITUATIONS OPEN RATES
Light face type $1.25 per line (ten words)	Light face type 40c per line (ten words)	Light face type $1.00 per line (ten words)
Bold face type $1.60 per line (eight words)	Bold face type 55c per line (eight words)	Bold face type $1.40 per line (eight words)
Allow nine words for keyed address.		*Letter replies forwarded without charge, but no packages or samples.*

Address All Replies to New York Office at 386 Fourth Avenue, New York 16, N. Y.

SITUATIONS OPEN

SMALL AGGRESSIVE RUBBER PLANT NEEDS A

CHEMICAL ENGINEER

EXPERIENCED IN THE DEVELOPMENT, COMPOUNDING FACTORY PROCESSING, AND APPLICATION OF TANK LININGS, ROLL COVERINGS, AND MOLDED GOODS.

This company has an unusual bonus and pension plan, pleasant surroundings and working conditions; therefore, if you are a wide-awake person and you know you can qualify—please give full details as to Education, Experience, Background, and Salary Requirements, along with a small Photograph if possible, in first letter.

Address Box No. 1459,
C/O INDIA RUBBER WORLD

Prominent National Packing Manufacturer has an opening in his modern research center for an experienced rubber compounder to devote full time to developing and compounding from synthetic and natural rubber products to meet specifications for industrial applications. Finest equipment and facilities in Northern New Jersey location. Our employees have been told of this advertisement. Apply Box 1463, c/o INDIA RUBBER WORLD.

RUBBER COMPOUNDERS

Large rubber company in Rocky Mountain Region needs: Compounder with extensive practical experience in tires. Capable of developing new formulas and production follow-up on mixing, extrusion, and calendering. Compounders with minimum experience of 2 years in broad compounding principles on various elastomers for belts, hose, tires, and molded rubber goods. Specific experience in any one field satisfactory. Address Box No. 1452, care of INDIA RUBBER WORLD.

CHEMIST—WITH ONE TO THREE YEARS' DRY RUBBER COMpounding experience to work in Eastern laboratory, with possible eventual transfer to technical sales. In responding, please include record of scholastic training, industrial experience, salary requirements, references, and recent snapshot photograph of yourself. Address Box No. 1453, care of INDIA RUBBER WORLD.

CONSULTING ENGINEER: SOUTH AMERICAN TIRE FACTORY wishes to enter into relation with a Rubber Engineer with experience as a plant manager and willing to act as consulting engineer. Address correspondence to MAROS BUYING SERVICE CO., INC., 15 Whitehall Street, New York 4, N. Y.

RUBBER TECHNOLOGIST

An unusual opportunity for graduate chemist or engineer with a minimum of 10 years of research and development experience in rubber compounding to work on challenging research programs in the rubber field. A working knowledge of rubber processing equipment and rubber chemistry is required. The position entails supervision and responsibility for the operation of a complete and modern rubber laboratory.

Excellent employee benefits: competitive salary scale, retirement plan, liberal vacations, hospitalization, credit union, and group life insurance, plus generous financial assistance for graduate study. Send résumé to:

J. A. Metzger
Armour Research Foundation
Technology Center
Chicago 16, Ill.

SITUATIONS OPEN (Continued)

CHEMICAL ENGINEER—OPENINGS AVAILABLE FOR YOUNG men who really want to grow with an expanding organization. Development work on very interesting products—mechanical goods, all types of synthetic rubber and plastics. We want men who have had a few years' well-rounded experience, who have imagination and ambition. State all particulars. Enclose picture if possible. Address Box No. 1450, care of INDIA RUBBER WORLD.

CHEMIST FOR A SMALL MOLDED RUBBER PLANT IN THE Philadelphia vicinity desired for quality control and research. Write résumé of background, experience, and compensation desired. Address Box No. 1451, care of INDIA RUBBER WORLD.

CHEMIST—MEDIUM-SIZE PLANT LOCATED EASTERN PENNA. Prefer practical man to theorist. Must have heavy experience and complete knowledge of Banbury compounding. Steady position, good pay, and opportunity to advance. If you are afraid of hard work, please don't apply. State age, experience, and salary requirement in first letter. Address Box No. 1464, care of INDIA RUBBER WORLD.

SITUATIONS WANTED

GERMAN RUBBER CHEMIST: GRADUATE, GOOD TECHNICAL background, excellent experience in the sale of raw materials to the rubber and plastics industries. Desires position as SALES REPRESENTATIVE FOR EUROPE. Address Box No. 1454, care of INDIA RUBBER WORLD.

CHEMICAL ENGINEER: WITH RUBBER, PLASTIC, AND LATEX experience, desires responsible position with aggresive organization. Competent in all phases of compounding, research, development, design, quality control, production, and plant management. Expert knowledge of colloid field. Excellent record and references. Address Box No. 1455, care of INDIA RUBBER WORLD.

OPPORTUNITY DESIRED, EXPERIENCED IN SMALL BUSIness management, sales, and broad technical work. Specialized in large- and small-plant product development, production problems, etc., primarily rubber field. Age 39. Prefer warm climate; foreign considered. Address Box No. 1456, care of INDIA RUBBER WORLD.

SUPERINTENDENT-CHEMIST DESIRES NEW CONNECTIONS. Capable as technical director or production manager. Broad practical and technical knowledge in manufacture of mechanical rubbers and sponge rubber products. Part-time work on consulting basis considered. Address Box No. 1457, care of INDIA RUBBER WORLD.

MACHINERY & SUPPLIES FOR SALE

BAKER PERKINS #14 JEM VACUUM MIXER, 50-GAL. WORKing cap, double-arm, sigma blade, jacketed shell. Kux model 25 Rotary Pellet Presses, 21 and 25 punch. Stokes Rotary Pellet Presses model RD-3 (16 punch) and model RDS-3 (15 punch). Ball & Jewell #1½ stainless-steel rotary cutter. Mikro Pulverizers #1-SH, #1-SI, #2-TH, and #2-SI. Large stock steel and stainless-steel tanks and kettles. PERRY EQUIPMENT CORP., 1424 N. 6th St., Phila. 22, Pa.

BUYING-SELLING All kinds of *used* machinery for the Rubber and Allied Industries.

OFFERING NEW MACHINERY Hydraulic Presses, Laboratory Mills and Presses, Sponge Rubber Vulcanizing Presses, Drilled Steel Steam Platens, Rubber Bale Cutters guillotine type, Vulcanizers with quick opening doors, etc.

HIGH EFFICIENCY IN QUALITY, PRICE AND DELIVERY TIME

ERIC BONWITT 431 S. Dearborn Street Chicago 5, Ill.

GOOD USED MACHINERY

WANTED YOUR IDLE EQUIPMENT

1—F. B. 32" x 92" Inverted-L 4-roll Calender, reduction drive, D.C. varispeed motor.
1—F. B. 24" x 84" Mill, w.c. bearings, reduction drive & 240 H.P., A.C., motor.
1—National-Erie 8" x 24" 2-roll Mill, 10 H.P. motor.
1—F. B. 6" x 13" self-contained 3-roll Calender, m.d.
1—Royle #4 Extruder, motor driven.
1—S. B. 8" x 16" 3-roll Calender, 20 H.P. motor.
1—6" x 12" Laboratory Mill, m.d.
2—Ball & Jewell #2 Rotary Cutters; 1—#1; 1, with 3 h.p. motor.
3—#28 Devine Vac. Shelf Dryers, 19-59" x 78" shelves, complete.
Also other sizes Hydraulic Presses, Tubers, Banbury Mixers, Mills, Vulcanizers, Calenders, Pellet Presses, Cutters.

PHONE—WIRE—WRITE • *Send us your inquiries*

Consolidated Products Company, Inc.

64 Bloomfield St., Hoboken, N. J.

N.Y. Tel.: BArclay 7-0600 HOboken 3-4425

"Our 37th Year" **Cable Address: Equipment Hoboken, N.J.**

COMPOUNDING INGREDIENTS*

Abrasives

Pumicestone, powdered	lb.	$0.025 /	$0.045
Rottenstone, domestic	lb.	.03 /	.04

Accelerators, Organic

A-10	lb.	.40 /	.47
A-19	lb.	.52 /	.58
A-32	lb.	.66 /	.80
A-77	lb.	.47 /	.60
A-100	lb.	.52 /	.66
Accelerator 49	lb.	.53 /	.54
552	lb.	2.25	
808	lb.	.66 /	.68
833	lb.	1.17 /	1.19
Altax	lb.	.48 /	.525
Arazate	lb.	.66 /	.71
Beutene	lb.	.61 /	.66
Bismate	lb.	3.00	
B-J-F	lb.	.27 /	.32
Butasan	lb.	1.04	
Butazate	lb.	1.04	
Butyl Accelerator 21	lb.	.89	
Eight	lb.	1.10 /	1.35
Zimate	lb.	1.04	
Captax	lb.	.38 /	.40
C-P-B	lb.	1.95	
Cumate	lb.	1.45	
Diesterex N	lb.	.50 /	.57
DOTG (diorthotolylguanidine)	lb.	.57 /	.58
DGP (diphenylguanidine)	lb.	.48 /	.55
El-Sixty	lb.	.50 /	.57
Ethasan	lb.	1.04	
Ethazate	lb.	1.04	
Ethyl Thiurad	lb.	1.04	
Tuads	lb.	1.04	
Tuex	lb.	1.04	
Zimate	lb.	1.04	
Ethylac	lb.	.93 /	.95
Hepteen	lb.	.44 /	.50
Base	lb.	1.85	
Ledate	lb.	1.04	
M-B-T	lb.	.38 /	.43
-XXX	lb.	.49 /	.51
M-B-T-S	lb.	.48 /	.53
-W	lb.	.53 /	.55
Merac	lb.	.75 /	1.05
Mertax	lb.	.49 /	.56
Methasan	lb.	1.04	
Methazate	lb.	1.04	
Methyl Tuads	lb.	1.14	
Zimate	lb.	1.04	
Monex	lb.	1.14	
Mono-Thiurad	lb.	1.14	
Morfex	lb.	.65 /	.70
NOBS No. 1	lb.	.69 /	.71
O-X-A-F	lb.	.49 /	.54
Pentex	lb.	1.04	
Flour	lb.	.21	
Permalux	lb.	2.17	
Phenex	lb.	.52 /	.59
Pip-Pip	lb.	2.07	
R-2 Crystals	lb.	2.45	
Rotax	lb.	.49 /	.51
RZ-50, -50B	lb.	1.00	
S. A. 52	lb.	1.14	
57, 62, 67, 77	lb.	1.04	
66	lb.	2.50	
Santocure	lb.	.69 /	.76
Selenac	lb.	2.50	
Setsit No. 5	lb.	.75 /	1.05
SPDX-GH	lb.	.64 /	.69
GL	lb.	.95	
Tellurac	lb.	1.45	
Tepidone	lb.	.45 /	.48
Tetrone A	lb.	1.91	
Thiocarbanilide (A-1)	lb.	.50 /	.57
Thiofide	lb.	.48 /	.55
S	lb.	.51 /	.58
Thionex	lb.	1.14	
Thiotax	lb.	.38 /	.45
Thiurad	lb.	1.14	
Thiuram E	lb.	1.04	
M	lb.	1.14	
Trimene	lb.	.56 /	.62
Base	lb.	1.03 /	1.10
Tuads	lb.	1.14	
Tuex	lb.	1.14	
Ultex	lb.	1.00 /	1.10
Unads	lb.	1.14	
Ureka Base	lb.	.66 /	.73
Vulcacure NB	lb.	.45	
ZB, ZE, ZM	lb.	.85	
Z-B-X	lb.	2.45	
Zenite	lb.	.48 /	.50
A	lb.	.57 /	.59
Special	lb.	.49 /	.51
Zetax	lb.	.49 /	.51
Zimate	lb.	1.04	

Accelerator-Activators, Inorganic

Lime, hydrated	ton	10.00 /	17.50
Litharge, comml.	lb.	.145 /	.15
Eagle, sublimed	lb.	.145 /	.146
Red Lead, comml.	lb.	.155 /	.165
Eagle	lb.	.155	
White lead, basic	lb.	.16 /	.17
Eagle, National Lead	lb.	.16 /	.17
White lead, silicate	lb.	.1525 /	.1875
Eagle	lb.	.17 /	.1875
National Lead	lb.	.1525 /	.1625
Zinc oxide, comml.†	lb.	.135 /	.1675

Accelerator-Activators, Organic

Aktone	lb.	$0.22 /	$0.23
Barak	lb.	.62	
Curade	lb.	.57 /	.59
D-B-A	lb.	1.95	
Delac P	lb.	.45 /	.52
Emersol 110	lb.	.13	.155
120	lb.	.135	.16
130	lb.	.1575	.1825
210 Elaine	lb.	.1375	.1725
Emery 600	lb.	.1075	.1425
Groco 30	lb.	.095	.13
35	lb.	.10	.135
53	lb.	.145	.1525
54	lb.	.15	.1675
55	lb.	.1725	.19
Rubber grade hydrogenated stearic acid	lb.	.1075	.125
Guantal	lb.	.57 /	.61
Hyfac 400	lb.	.10 /	.125
430	lb.	.1475 /	.1725
431	lb.	.17 /	.195
Laurex	lb.	.30 /	.33
MODX	lb.	.295 /	.345
NA-22	lb.	1.50	
Plastone	lb.	.27 /	.30
Polyac	lb.	1.65	
Seedine	lb.	.1485 /	.1705
Stearex Beads	lb.	.14⅞ /	.15⅞
Stearic acid, single pressed	lb.	.145 /	.1625
Double pressed	lb.	.15 /	.1675
Triple pressed	lb.	.1725 /	.19
Tonox	lb.	.515 /	.605
Vulklor	lb.	.75 /	.95
Zinc stearate	lb.	.37 /	.42

Alkalies

Caustic soda, flake	100 lbs.	4.10 /	5.30
Liquid, 50%	100 lbs.	2.55 /	2.75
Solid	100 lbs.	3.70 /	4.90

Antioxidants

AgeRite Alba	lb.	2.35 /	2.45
Gel	lb.	.64 /	.66
H. P.	lb.	.72 /	.74
Hipar	lb.	.98 /	1.00
Powder	lb.	.52 /	.54
Resin	lb.	.75 /	.77
D	lb.	.52 /	.54
Spar	lb.	.52 /	.54
Stalite	lb.	.52 /	.54
White	lb.	1.45 /	1.55
Akroflex C	lb.	.72 /	.79
CD	lb.	.72 /	.74
Albasan	lb.	.69 /	.73
Aminox	lb.	.52 /	.57
Antioxidant 2246	lb.	1.65 /	1.68
Antisol	lb.	.23 /	.24
Antox	lb.	.52 /	.54
Aranox	lb.	3.25	
Betanox Special	lb.	.80 /	.85
B-L-E, -25	lb.	.52 /	.57
Burgess Antisun Wax	lb.	.185	
B-X-A	lb.	.52 /	.57
Copper Inhibiter X-872-L	lb.	2.01	
Flectol H	lb.	.52 /	.59
Flexamine	lb.	.72 /	.77
Heliozone	lb.	.26 /	.27
Ionol	lb.	.91 /	1.40
NBC	lb.	1.55	
Neozone A	lb.	.56 /	.58
D	lb.	.52 /	.54
Octamine	lb.	.52 /	.57
Perflectol	lb.	.61 /	.68
Polygard	lb.	.52 /	.57
Rio Resin	lb.	.60 /	.62
Santoflex 35	lb.	.72 /	.79
AW	lb.	.78 /	.85
B	lb.	.52 /	.59
BX	lb.	.63 /	.70
Santovar A	lb.	1.50 /	1.57
O	lb.	1.30 /	1.37
Santowhite Crystals	lb.	1.60 /	1.67
L	lb.	.52 /	.59
MK	lb.	1.29 /	1.36
Sharples Wax	lb.	.23 /	.28
Stabilite	lb.	.55 /	.59
Alba	lb.	.72 /	.79
L	lb.	.60 /	.64
White	lb.	.53 /	.62
Powder	lb.	.41 /	.47
Styphen I	lb.	.51 /	.55
Sunolite	lb.	.21 /	.25
Sunproof -713	lb.	.25 /	.30
Improved	lb.	.25 /	.30
Jr.	lb.	.20 /	.25
Thermoflex A	lb.	.98 /	1.00
Tonox	lb.	.52 /	.57
Tysonite	lb.	.24 /	.2475
V-G-B	lb.	.70 /	.75
Wing-Stay S	lb.	.52 /	.61
Zenite	lb.	.33 /	.35

Antiseptics

Copper naphthenate, 6-8%	lb.	.215	
Pentachlorophenol	lb.	.21 /	.29
Resorcinol, technical	lb.	.775 /	.785
Zinc naphthenate, 8-10%	lb.	.245 /	.30

Blowing Agents

Ammonium, bicarbonate	lb.	.065 /	.075
Carbonate	lb.	.23 /	.24
Blowing Agent CP- 975	lb.	$0.35	
Celogen	lb.	1.95	
50-C	lb.	1.01 /	$1.07
Sodium bicarbonate	100 lbs.	2.30 /	3.70
Carbonate, tech.	100 lbs.	1.35 /	5.02
Sponge Paste	lb.	.20	
Unicel	lb.	.90	
ND	lb.	.79	
S	lb.	.20	

Bonding Agents

G-E Silicone Paste SS-15	lb.	4.52 /	5.10
SS-64	lb.	3.65 /	6.75
-67 Primer	lb.	7.50 /	12.50
Gen-Tac Latex	lb.	.75 /	.855
Kalabond Adhesive	gal.	6.50 /	16.00
Tie Cement	gal.	2.00 /	5.60
MDI	lb.	4.00 /	6.00
-50	lb.	2.00 /	3.00
Thixons	gal.	1.48 /	12.00
Ty Ply BN, Q, S, 3640	gal.	6.75 /	8.00

Brake Lining Saturants

BRT 3	lb.	.018 /	.0265
Resinex L-S	lb.	.0225 /	.03

Carbon Blacks‡

Conductive Channel—CC

Continental R-40	lb.	.23 /	.30
Kosmos/Dixie BB	lb.	.23 /	.30
Spheron C	lb.	.14 /	.185
I	lb.	.12 /	.165
N	lb.	.25 /	.29
Voltex	lb.	.18 /	.315

Easy Processing Channel—EPC

Continental AA	lb.	.074 /	.1225
Kosmobile 77/Dixiedensed 77	lb.	.074 /	.1225
Micronex W-6	lb.	.074 /	.1225
Spheron #9	lb.	.074 /	.1225
Texas E	lb.	.074 /	.1175
Witco #12	lb.	.074 /	.1225
Wyex	lb.	.074 /	.12

Hard Processing Channel—HPC

Continental F	lb.	.074 /	.1225
HX	lb.	.074 /	.12
Kosmobile S/Dixiedensed S	lb.	.074 /	.1225
Micronex Mk. II	lb.	.074 /	.1225
Spheron #4	lb.	.074 /	.1225
Witco #6	lb.	.074 /	.1225

Medium Processing Channel—MPC

Arrow TX	lb.	.074 /	.12
Continental A	lb.	.074 /	.1225
Kosmobile S-66/Dixiedensed S-66	lb.	.074 /	.1225
Micronex Standard	lb.	.074 /	.1225
Spheron #6	lb.	.074 /	.1225
Texas M	lb.	.074 /	.1175
Witco #1	lb.	.074 /	.1225

Conductive Furnace—CF

Aromex 115	lb.	.089 /	.129
Vulcan C	lb.	.11 /	.153
SC	lb.	.18 /	.223

Fast Extruding Furnace—FEF

Arovel	lb.	.06 /	.10
Continental FEF	lb.	.06 /	.10
Kosmos 50/Dixie 50	lb.	.06 /	.10
Statex M	lb.	.06 /	.10
Sterling SO	lb.	.06 /	.10

Fine Furnace—FF

Statex B	lb.	.065 /	.105
Sterling 99	lb.	.065 /	.105

High Abrasion Furnace—HAF

Aromex	lb.	.079 /	.125
Continex HAF	lb.	.079 /	.125
Kosmos 60/Dixie 60	lb.	.079 /	.1175
Philblack O	lb.	.079 /	.119
Statex R	lb.	.079 /	.125
Vulcan #3	lb.	.079 /	.122

Medium Abrasion Furnace—MAF

Philblack A	lb.	.06 /	.10

Super Abrasion Furnace—SAF

Kosmos 70/Dixie	lb.	.11 /	.155
Philblack E	lb.	.135 /	.175
I	lb.	.11 /	.15
Statex 125	lb.	.11 /	.155
Vulcan 6	lb.	.11	.153
9	lb.	.135	.178

General-Purpose Furnace—GPF

Sterling V	lb.	.05 /	.09

*Prices in general are f.o.b. works. Range indicates grade or quantity variations. Space limitation prevents listing of all known ingredients. Prices are not guaranteed; contact suppliers for spot prices.

†For trade names, see Color—White, Zinc Oxides.

‡At the request of the suppliers, the lowest prices shown for carbon blacks are for carloads in bags. Prices for hopper carloads are lower.

CLASSIFIED ADVERTISEMENTS

Continued

MACHINERY AND SUPPLIES FOR SALE (Continued)

FOR SALE: FARREL 16" X 48" and 15" X 36", 2-ROLL RUBBER mills, and other sizes up to 84". Also new and used lab. 6" x 12" & 6" x 16" mixing mills and calenders. Six American Tool 300-gallon Churns. Extruders 1" to 6". Baker-Perkins Jacketed Mixers 100, 50, and 9 gals., heavy-duty double-arm. 350-ton upstroke Hydr. Press 22" x 24" platens. 325-ton upstroke 42" x 24" platens. Brunswick 200-ton 21" x 21" platens. Large stock of hydraulic presses from 12" x 12" to 48" x 48" platens from 50 to 2,000 tons. Hydraulic Pumps and Accumulators. Rotary Cutters. Stokes Automatic Molding Presses. Single Punch & Rotary Preform Machines. Banbury Mixers, Crushers, Churns, Rubber Bale Cutters, etc. SEND FOR SPECIAL BULLETIN. WE BUY YOUR SURPLUS MACHINERY. STEIN EQUIPMENT CO., 107 — 8th St., Brooklyn 15, N. Y. STerling 8-1944.

FOR SALE: COMPLETE #9 BANBURY BODY FULLY REBUILT; 1 pair #27 Banbury steel rotors, rebuilt; #27 Banbury side jackets, rebuilt; #27 Banbury bull gear, pinion and pinion shaft. INTERSTATE WELDING SERVICE, Offices, Metropolitan Bldg., Akron 8, Ohio.

INDUSTRIAL STEEL CONTAINERS

800 — USED

10 gal. galv. riveted shipping containers, 33" high by 24" dia. with water-tight rubber gasket sealed removable lid. Jaybolt fastened, weight 127#. Can be used for transportation of chemicals, paints, solvents, metal parts. They are galv., painted alum., inside and outside. In excellent condition. Orig. cost—$40.00 ea. Our price—$10.00. F.O.B. Philadelphia.

DALTON SUPPLY CO.

2829 Cedar Street **Philadelphia, Pa.**

RUBBER HARDNESS

THE LANGUAGE OF THE RUBBER INDUSTRY SINCE 1915

DUROMETER

VARIOUS MODELS FOR TESTING THE ENTIRE RANGE

TECHNICAL DATA ON REQUEST

THE SHORE INSTRUMENT & MFG. CO., INC.

90-35 VAN WYCK EXPRESSWAY
JAMAICA 2, N. Y.

USED MACHINERY

FOR SALE

1—Ambaco Model 3A Continuous Baler.
2—Thropp 2-roll Rubber Mills, 18"x50".
1—Link-Belt Steel Roto Louvre Dryer, size 7½'x20'.
1—Adamson Vulcanizer, 2' x 12' with quick opening door.
2—Devine Vacuum Shelf Dryers—12 Shelves.
1—Paul O. Abbe #2 Master Rotary Cutter with Ball Bearings.
1—Welding Engr. Stainless Steel #2 Extruder.
14—Baker Perkins Steel Jacketed Mixers—100 gals.—Type 15 JIM 2. Late type construction.
1—Baker Perkins Stainless Steel double-arm jacketed mixer, Sigma blade, 9 gal.

WE ARE INTERESTED IN PURCHASING ALL TYPES OF RUBBER machinery consisting of mills, Banbury mixers, extruders, calenders, vulcanizers, etc. and also complete plants.

R. GELB & SONS Inc.
STATE HIGHWAY No. 29, UNION, N.J.
UNIONVILLE-2-4900

RUBBER MACHINERY AVAILABLE FOR IMMEDIATE DELIVERY

The machinery listed below was manufactured for a foreign customer who has been unable to take delivery because of political conditions in his country. The machinery is brand-new, is packed for export, and is in storage. We have been authorized to offer it for immediate sale, subject to prior bid. For full details of any items in which you may be interested, apply to

FARREL-BIRMINGHAM COMPANY, INC.

ANSONIA, CONN.

Rubber Machinery

2 Size 11 Banbury Mixers and Drives
1 12" Plasticator and Drive
2 24" x 66" 3-Roll Calenders and Drives
2 26" x 84" Mills and Drives
10 22" x 60" Mills and Drives
5 Strip Cutters for 60" or 84" Mills
2 Rubber Bale Cutters

Speed Reducers

1 DR-33 Double Reduction Unit, 12.54/1 Ratio
1 DR-24 Double Reduction Unit, 12.5/1 Ratio
1 DR-20 Double Reduction Unit, 12.43/1 Ratio
1 SR-2614 Single Reduction Unit, 9.83/1 Ratio
1 SR-2011 Single Reduction Unit, 10/1 Ratio

Chilled Iron Rolls

3	22" x 66" Rolls	10	14" x 36" Rolls
2	22" x 50" Rolls	4	12" x 30" Rolls
2	20" x 50" Rolls	2	9¾" x 25" Rolls
16	18" x 48" Rolls	6	9-7/16" x 25" Rolls
4	16" x 44" Rolls	24	9⅛" x 25" Rolls
4	16" x 42" Rolls	6	9" x 25" Rolls
4	16" x 30" Rolls	1	9" x 25" Nihard Roll

FB-918

High Modulus Furnace—HMF

Continex HMF	lb.	$0.055 /	$0.095
Kosmos 40/Dixie 40	lb.	.055 /	.095
Modulex	lb.	.055 /	.095
Statex 93	lb.	.055 /	.095
930	lb.	.047 /	.087
Sterling L, LL	lb.	.055 /	.095

Semi-Reinforcing Furnace—SRF

Continex SRF	lb.	.045 /	.085
Essex	lb.	.045 /	.085
Furnex	lb.	.045 /	.085
Gastex	lb.	.05 /	.09
Kosmos 20/Dixie 20	lb.	.045 /	.085
Pelletex, NS	lb.	.045 /	.085
Sterling NS, S	lb.	.045 /	.085
R	lb.	.05 /	.09

Fine Thermal—FT

P-33	lb.	.055	
Sterling FT	lb.	.055	

Medium Thermal—MT

Sterling MT	lb.	.035	
Non-staining	lb.	.045	
Thermax	lb.	.035	
Stainless	lb.	.045	

Chemical Stabilizers

Argus stabilizers	lb.	.60 /	1.38
Dutch Boy DS-207	lb.	.53 /	.55
Dyphos	lb.	.56 /	.58
Dythal	lb.	.40 /	.42
Normasal	lb.	.45 /	.47
Plumb-O-Sil A	lb.	.2875/	.3075
B	lb.	.3025/	.3225
C	lb.	.3325/	.3525
Tribase	lb.	.265 /	.285
E	lb.	.235 /	.255
Eagle Basic Silicate White			
Lead 201	lb.	.1775/	.1875
202	lb.	.17 /	.18
Stabelans	lb.	.60 /	1.70
Staycin 1	lb.	.65	
Vanstay HT	lb.	.90 /	.92
HTR	lb.	1.20 /	1.22
L	lb.	.33 /	.35
S	lb.	.65 /	.70
Witco Lead Stearate #30	lb.	.32 /	.37
P-30	lb.	.39 /	.44
Stayrite #10	lb.	.32 /	.37
P-10	lb.	.39 /	.44
#15	lb.	.53 /	.57
#20	lb.	.37 /	.42
#22	lb.	1.40 /	1.44
#25	lb.	.35 /	.40
#70, 80, 90	lb.	.70	

Colors

Black

Black Paste #25	lb.	.22 /	.40
BK Iron Oxides	lb.	.1275/	.13
Covinylblaks	lb.	.68 /	.145
Ivo Bone Blacks	lb.	.15 /	.2025
Lampblack, comml	lb.	.16 /	.45
Superjet	lb.	.0825/	.1175
Mapico	lb.	.1275/	.13
MB Mineral Blacks	lb.	.0315/	.0675
Stan-Tone	lb.	.45 /	1.20

Blue

Du Pont	lb.	1.77 /	4.55
Heveatex pastes	lb.	.80 /	1.45
Stan-Tone	lb.	1.55 /	1.60
Toners	lb.	.30 /	3.50

Brown

Brown Paste #5, #10	lb.	.35 /	.45
Mapico	lb.	.1375/	.205
Tan	lb.	.1975/	.20
Metallic brown	lb.	.04 /	.05
Plastics brown	lb.	.0625/	.07
Sienna, burnt	lb.	.0425/	.155
Raw	lb.	.045 /	.1325
Umber, burnt	lb.	.06 /	.07
Raw	lb.	.0625/	.07

Green

Chrome	lb.	.19 /	.50
Oxide	lb.	.3925/	1.10
Du Pont	lb.	1.97 /	3.20
G-4099, -6099	lb.	.3925/	.3975
GH-9869	lb.	1.00 /	1.15
9976	lb.	1.10 /	1.25
Heveatex pastes	lb.	.95 /	1.85
Stan-Tone	lb.	1.75 /	4.60
Toners	lb.	.35 /	4.00

Orange

Du Pont	lb.	2.75	
Orange Paste #13	lb.	1.35 /	1.50
Stan-Tone	lb.	.70 /	3.35
Toners	lb.	.30 /	1.50

Red

Antimony trisulfide	lb.	.27 /	.30
R. M. P. No. 3	lb.	.72 /	
Sulfur Free	lb.	.78 /	
Cadmium red lithopone	lb.	1.64 /	2.05
Cadmolith	lb.	1.72 /	2.05
Du Pont	lb.	1.47 /	1.80
Indian Red	lb.	.1275	
Iron oxide, red	lb.	.06 /	.13
Mapico	lb.	.1275/	.13
Red Paste #17, I-2	lb.	.95 /	1.10
Rub-Er-Red	lb.	.0975	
Stan-Tone	lb.	1.05 /	4.05
Toners	lb.	.25 /	4.15

White

Antimony oxide	lb.	$0.26 /	$0.275
Burgess Iceberg	ton	50.00	
Lithopone, titanated	lb.	.10 /	.11
Cryptone BT	lb.	.10 /	.11
Titanium pigments			
Rayox LW	lb.	.195 /	.205
R-110	lb.	.215 /	.225
Ti-Cal	lb.	.075 /	.0825
Ti-Pure	lb.	.195 /	.225
Titanox A, AA, A-168	lb.	.21 /	.22
C-50	lb.	.1225/	.1275
RA, -10, -50	lb.	.23 /	.24
RC	lb.	.0825/	.0875
-HT, -HTX	lb.	.08 /	.085
Zopaque	lb.	.21 /	.22
Zinc oxide, comml	lb.	.135 /	.1675
Azo ZZZ-11, -44, -55	lb.	.135 /	.145
20% leaded	lb.	.1375/	.1475
35% leaded	lb.	.14 /	.15
50% leaded	lb.	.14⅛/	.15⅛
Eagle AAA, lead free	lb.	.135 /	.145
5% leaded	lb.	.135 /	.145
35% leaded	lb.	.14 /	.15
50% leaded	lb.	.14⅛/	.15⅛
Florence Green Seal	lb.	.1525/	.1625
Red Seal	lb.	.1475/	.1575
White Seal	lb.	.1575/	.1675
Horsehead XX-4, -78	lb.	.135 /	.145
Kadox -15, -17, -22	lb.	.135 /	.145
-25	lb.	.1575/	.1675
Lehigh, 35% leaded	lb.	.14 /	.15
50% leaded	lb.	.14⅛/	.15⅛
Protox-166, -167	lb.	.135 /	.145
St. Joe, lead free	lb.	.135 /	.145
Zinc sulfide, comml	lb.	.253 /	.263
Cryptone ZS	lb.	.253 /	.263

Yellow

Cadmium yellow lithopone	lb.	1.20 /	1.21
Cadmolith	lb.	1.29 /	1.37
Chrome	lb.	.31 /	.33
Du Pont	lb.	1.80 /	2.15
Iron oxide, yellow	lb.	.038 /	.1075
Mapico	lb.	.105 /	.1075
Stan-Tone	lb.	1.00 /	1.55
Toners	lb.	.50 /	1.37
Yellow D	lb.	1.25 /	1.35

Dispersing Agents

Darvan Nos. 1, 2, 3	lb.	.22 /	.30
Kreelons	lb.	.15 /	.16
Modicols	lb.	.17 /	.58
Triton R-100	lb.	.12 /	.25

Dusting Agents

Extrud-o-Lube, conc.	gal.	1.54 /	1.69
Glycerized Liquid Lubricant, concentrated	gal.	1.48 /	1.63
Lubrex	lb.	.25 /	.30
Mica	lb.	.075 /	.085
Pyrax A	ton	13.50	
W. A.	ton	16.00	
Snow Crest Talc	ton	33.00 /	35.00
Vanfre	gal.	2.00 /	2.50

Extenders

BRS 700	lb.	.02 /	.0285
BRT 7	lb.	.03 /	.031
Burgess MX-50	ton	150.00	
Car-Bel-Ex A	lb.	.14	
Dielex B	lb.	.06	
Factice, Amberex	lb.	.29 /	.36
Brown	lb.	.1425/	.268
Neophax	lb.	.157 /	.268
White	lb.	.144 /	.285
Mineral Rubbers			
Black Diamond	ton	38.00 /	40.00
Extender 600	lb.	.185	
Hard Hydrocarbon	ton	46.50 /	48.50
Hydrocarbon MR	ton	45.00 /	55.00
Parmr	ton	21.00 /	29.00
T-MR Granulated	ton	47.50 /	50.00
Nuba No. 1, 2	lb.	.0575/	.0625
3X	lb.	.0775/	.0825
Rubber substitute, brown	lb.	.137 /	.2625
White	lb.	.156 /	.292
Stan-Shells	ton	35.00 /	73.00
Synthetic 100	lb.	.41	

Fillers, Inert

Barytes, floated, white	ton	41.60 /	60.10
Off-color, domestic	ton	25.00	
No. 1	ton	41.35 /	60.10
2	ton	39.35 /	58.00
Sparmite	ton	75.00 /	80.00
Blanc fixe	ton	100.00 /	165.00
Clays			
Aiken	ton	14.00	
Albacar	ton	50.00 /	55.00
Aluminum Flake	ton	20.00 /	60.00
#5	ton	23.50 /	26.50
Champion	ton	14.00	
Crown	ton	14.00 /	33.00
GK Soft Clay	ton	11.00	
Hi-White R	ton	13.50	
Hydratex R	ton	28.00	
Paragon	ton	13.50 /	31.50
McNamee	ton	13.50	
RX-43	ton	33.00	
Stan-Clay	ton	28.00	
Stellar-R	ton	50.00	
Suprex	ton	14.00 /	32.00
W-1291 English	ton	53.00 /	55.00
Witco #1	ton	14.00 /	30.00
#2	ton	13.50 /	30.00
Cryptone BA, CB, MS	lb.	$0.08 /	$0.0825
Flocks			
Cotton, dark	lb.	.095 /	.112
Dyed	lb.	.55 /	.60
White	lb.	.13 /	.33
Fabrifil X-24-G	lb.	0.095	
X-24-W	lb.	.135	
Filfloc 6000	lb.	.16	
F-40-900	lb.	.105	
Kalite	ton	50.00 /	65.00
Lithopone, comml	lb.	.075 /	.085
Albalith	lb.	.075 /	.085
Astrolith	lb.	.06⅜/	.0675
Eagle	lb.	.0725/	.075
Sunolith	lb.	.079 /	.089
Mica	lb.	.075 /	.085
Millical	ton	35.00 /	50.00
No. 1 Silica	ton	22.00 /	40.00
Non-Fer-Al	ton	30.00 /	45.00
Pyrax A	ton	12.50	
W. A.	ton	15.00	
SL Slate Flour	ton	17.00 /	25.00
Stan-White	ton	8.50 /	9.45
Super-White Silica	ton	23.00 /	43.00
Suspenso	ton	33.00 /	48.00
Terra Alba 1319	ton	27.00	
Ti-Cal	lb.	.0675	
Whiting, limestone	ton	32.00 /	34.00
Calcite	ton	21.50	
Paxinosa	ton	10.00 /	18.00
Witco	ton	8.50	

Finishes

Black-out	gal.	4.50 /	8.00
Flocks			
Cotton, dark	lb.	.095 /	.112
Dyed	lb.	.55 /	.60
White	lb.	.13 /	.33
Rayon, colored	lb.	.90 /	1.50
White	lb.	.75 /	1.25
Rubber lacquer, clear	gal.	1.00 /	2.00
Colored	gal.	2.00 /	3.50
Shoe varnish	gal.	1.45	
Talc	ton	14.00 /	38.50
Nytals	ton	25.00 /	36.00
Wax, Bees	lb.	.52 /	.69
Carnauba	lb.	.82 /	1.18
Montan	lb.	.135 /	.32
No. 118, colors	gal.	.86 /	1.41
Neutral	gal.	.76 /	1.31
Van Wax	gal.	1.45 /	1.50

Latex Compounding Ingredients

Accelerator 552	lb.	2.25	
J-117, -302	lb.	1.00 /	1.15
-144	lb.	.15 /	.30
-307	lb.	1.10 /	1.25
-311	lb.	.60 /	.75
Aerosol	lb.	.35	
AgeRite Dispersions	lb.	.60 /	2.25
Alcogum AN-6	lb.	.05	
AN-10	lb.	.085	
Amberex Solutions	lb.	.1675/	.18
Antifoam J-114	lb.	3.25 /	3.45
P-242	lb.	.24 /	.35
Antioxidant J-137, -140	lb.	.55 /	.70
-139, -293	lb.	1.45 /	1.60
-182	lb.	2.00 /	2.15
-186	lb.	1.40 /	1.55
Anti-Webbing Agent J-183	lb.	.75 /	.90
-297	lb.	.27 /	.40
Aquablaks	lb.	.085 /	.1775
Aquarex D	lb.	.78	
G	lb.	.21	
L	lb.	.94	
MDL	lb.	.33	
ME	lb.	.94	
NS	lb.	.60	
SMO	lb.	.50	
WAQ	lb.	.25	
Areskap 50	lb.	.30 /	.38
100, dry	lb.	.60 /	.72
Aresket 240	lb.	.30 /	.38
300, dry	lb.	.60 /	.72
Aresklene 375	lb.	.42 /	.57
Black No. 25, dispersed	lb.	.22	
Casein	lb.	.22 /	.40
Coagulant P-379	gal.	1.30 /	1.90
-392	gal.	1.55 /	2.15
CW-12	lb.	.85	
37	lb.	.70	
Dispersed Sulfur No. 2	lb.	.10 /	.12
Factice dispersions	lb.	.26 /	.42
Gelling Agent P-397	lb.	.34 /	.37
Habuco Resin Emulsion			
#226	lb.	.227 /	.232
2246-A	lb.	.275 /	.28
3408-B	lb.	.18 /	.19
Laton L	lb.	.075 /	.0775
Ludox	lb.	.1675/	.1925
Marmix	lb.	.41 /	.48
Micronex, colloidal	lb.	.06 /	.07
Pliolite Latex 150, 190	lb.	.32 /	.41
170	lb.	.37 /	.46
Resin Emulsion A-2	lb.	.16 /	.25
P-370	lb.	.175 /	.25
X-210	lb.	.12 /	.22
Resin V	lb.	.13 /	
Santomerse D	lb.	.44 /	.65
S	lb.	.13 /	.25
Stablex A	lb.	.80 /	1.10
B, G	lb.	.50 /	.95
K	lb.	.27 /	.35
P	lb.	.35 /	.50
T	lb.	.14 /	.22
Sulfur dispersions	lb.	.12 /	.30
Webnix #34	lb.	1.50 /	2.25
Zinc oxide dispersions	lb.	.21 /	.34

CLASSIFIED ADVERTISEMENTS

Continued

MACHINERY AND SUPPLIES FOR SALE (Continued)

FOR SALE: 3—42" X 42" HYDRAULIC PRESSES, 16 AND 20" rams. 1—10" x 20" rubber mill, M.D. 1—10" x 24" 4-roll calender, M.D. 1—6' x 12' vulcanizer, Q.O. door. Also Banbury mixers, calenders, hydraulic presses, cutters, etc. CHEMICAL & PROCESS MACHINERY CORP., 148 Grand Street, New York 13, N. Y.

FOR SALE: FOUR SOUTHWARK SINGLE-OPENING RUBBER molding presses, platen size 24" x 24", ram size 14", openings 8", 9", 11½", and 11½". RODALE MFG. CO., INC., Emmaus, Pa.

FOR SALE: BRAND-NEW 20 X 22 X 60 MILL WITH MOTOR AND drive. Also 36-inch ram multi-opening slab-side press, new. Address Box No. 1462, care of INDIA RUBBER WORLD.

Mold Lubricants

Aquarex Compounds	lb.	$0.28	$0.97
Colite Concentrate	gal.	.90	1.15
ELA	lb.	.82	
DC Mold Release Fluid	lb.	4.14	6.00
Emulsion Nos. 35, 35A, 35B	lb.	1.46	3.50
DC 7	lb.	6.20	6.80
Glycerized Liquid Lubricant, concentrated	gal.	1.48	1.63
Lubrex	lb.	.25	.30
Lubri-Flo	gal.	10.00	12.05
Mold Paste	lb.	.25	
Monten Wax	lb.	.57	
Para Lube	lb.	.046	.048
Polyglycol E series	lb.	.29	.42
Rubber-Glo	gal.	.94	.97
Soap, Hawkeye	lb.	1.35	1.45
Purity	lb.	.155	.165
Sodium stearate	lb.	.40	
Vanfre	gal.	2.50	3.00

Odorants

Alamasks	lb.	.75	6.50
Curodex 19	lb.	4.75	
188	lb.	5.75	
198	lb.	6.75	
Rodo No. 0	lb.	4.00	4.50
No. 10	lb.	5.00	5.50

Plasticizers and Softeners

Akroflex C	lb.	.695	.715
Aro Lene #1980	lb.	.10	.12
Baker AA Oil	lb.	.195	.24
Crystal O Oil	lb.	.21	.255
Processed oils	lb.	.215	.235
Bardol	lb.	.0275	.0375
639	lb.	.0275	.045
B	lb.	.0625	.065
Bondogen	lb.	.55	.60
BRC 20	lb.	.15	.175
30	lb.	.0125	.021
521	lb.	.019	.02
BRH 2	lb.	.0213	.0351
BRS 700	lb.	.02	.0285
BRT 7	lb.	.03	.031
BRV	lb.	.0475	.0565
Bunarex Liquid	lb.	.0425	.0555
Resins	lb.	.065	.1225
Bunnatol G. S.	lb.	.40	.505
Butac	lb.	.125	.135
BxDC	lb.	.40	.41
Cabflex DDA	lb.	.4475	.4775
DDP	lb.	.34	.37
Di-BA	lb.	.4325	.4625
OA	lb.	.4475	.4775
OP	lb.	.34	.37
OZ	lb.	.52	.5475
ODA	lb.	.4475	.4775
ODP	lb.	.34	.37
Cabol 100	lb.	.02	.07
Carbonex S	lb.	.0475	.05
Chlorowax 40	lb.	.145	.225
70	lb.	.18	.24
-S	lb.	.21	.27
Contogums	lb.	.0875	.111
Cumar EX	lb.	.0525	
MH	lb.	.065	.11
V	lb.	.0975	.1275
Darex Plasticizer DBM	lb.	.30	.3275
Dielex B	lb.	.06	
Dipolymer Oil	gal.	.33	.38
Dispersing Oil No. 10	lb.	.06	.0625
Duraplex C-50 LV, 100%	lb.	.25	.295
Dutrex 6	lb.	.025	.035
Fortex	lb.	.125	.145
Galex W-100	lb.	.135	.1725
W-100D	lb.	.1325	.17
Gilsowax B	lb.	.09	.11
Good-rite GP-233	lb.	.4475	.11
GP-261	lb.	.34	.49
Harchemex	lb.	.3025	.3925
Harflex 500	lb.	.315	.345
Heavy Resin Oil	lb.	.0225	.0375
HSC-13	lb.	.27	.30
Indoil Compound 51-S	lb.	1.00	1.10
Indonex	gal.	.11	.19
Marvinol plasticizers	lb.	.28	.8825
Nevillac	lb.	.31	.85
Neville R. Resins	lb.	.13	.35
Nevinol	lb.	.20	
No. 1-D heavy oil	lb.	.055	.065
Palmalene	lb.	.15	
Paraflex BN-1	lb.	.185	.225
Para Flux, regular	gal.	.10	.2125
No. 2016	gal.	.165	.24
2332	gal.	.11	
4205	lb.	.1075	.2125
Para Lube	lb.	.046	.048
Resins	lb.	.04	.045
Paradene Resins	lb.	.065	.075
Peptizene #2	lb.	.90	
Pepton 22	lb.	.79	.82
Picco Resins	lb.	.13	.185
480 Oilproof Series	lb.	.18	.23
S. O. S.	gal.	.29	.34
Piccocizers	lb.	.04	.068
Piccolastic Resins	lb.	.1855	.34
Piccolyte Resins	lb.	.185	.25
Piccopale Resins	lb.	.12	.135
Piccoumaron Resins	lb.	.07	.185
Piccovars	lb.	.145	.20
Piccovol	lb.	.025	.038
Pictar	gal.	.25	.30
Pigmentar, American	lb.	.041	.0678
Sunny South	lb.	.0389	.0678
Pigmentaroil, American	lb.	.041	.0678
Sunny South	lb.	.0389	.0678
Pitch, Burgundy Sunny South	lb.	$0.098	$0.1025
Plasticizer 35	lb.	.205	.24
36	lb.	.305	.34
42	lb.	.34	.40
B	lb.	.35	.45
DP-520	lb.	.435	.455
MT-511	lb.	.535	.565
ODN	lb.	.32	.37
PX series	lb.	.385	.75
SC	lb.	.61	.69
Plastogen	lb.	.0775	.08
Plastone	lb.	.22	.30
Polycizers	lb.	.40	.4775
PT67 Light Pine Oil	gal.	.60	
101 Pine Tar Oil	gal.	.335	.445
Pine Tars	gal.	.35	.46
R-19, R-21 Resins	lb.	.1075	
Reogen	lb.	.1325	.135
Resin C pitch	lb.	.0225	.031
R6-3	lb.	.38	.40
Resinex	lb.	.0325	.0375
L-4	lb.	.0225	.03
Rosin Oil, Sunny South	gal.	.58	.875
RPA No. 2	lb.	.78	
3	lb.	.47	
Conc.	lb.	.97	
5	lb.	.59	
RSN Flux	gal.	.10	.19
Rubber Oil B-5	lb.	.0225	.0355
Rubberol	lb.	.2575	.2725
Seedine	lb.	.1485	.1705
Softener #20	gal.	.10	.20
Special Rubber Resin	100 lb.	.1675	.2175
Starex Beads	lb.	.14⅞	.15⅞
Starite	lb.	.095	.10
Syn-Tac	gal.	.33	.35
Synthol	lb.	.2475	
Thiokol TP-90B	lb.	.59	.69
-95, -98	lb.	.65	
TR-11	lb.	.035	
Turgum S	lb.	.1075	.1175
Tysonite	lb.	.24	.2475
X-1 Resinous Oil	lb.	.021	.0275
XX-100 Resin	lb.	.0525	

Reclaiming Oils

Bardol	lb.	.0275	.0375
639	lb.	.0275	.045
B	lb.	.0625	.065
BRH 2	lb.	.0213	.0351
BRT 4	lb.	.025	.026
BRV	lb.	.0475	.0565
Burco-RA	lb.	.055	.0825
BWH-1	lb.	.16	.18
Dipolymer Oil	gal.	.33	.43
Dispersing Oil No. 10	lb.	.06	.0625
Heavy Resin Oil	lb.	.0225	.0375
LX-759	gal.	.16	.165
-774, -777	gal.	.23	.33
No. 1621	lb.	.025	.035
3186	gal.	.28	.295
Picco 6535	gal.	.25	.30
C-33	gal.	.215	.315
-42	gal.	.23	.33
D-4	gal.	.27	.37
E-5	gal.	.25	.35
Q-Oil	gal.	.286	.36
PT 101 Pine Tar Oil	gal.	.335	.445
150 Pine Solvent	gal.	.44	
Reclaiming Oil #3186	gal.	.28	.385
-G	gal.	.25	.365
4039-M	gal.	.3275	.3975
-Y	gal.	.30	.37
RR-10	lb.	.36	
S. R. O.	lb.	.015	.0225
X-1 Resinous Oil	lb.	.021	.03

Reinforcers, Other Than Carbon Black

BRC 20	lb.	.15	.175
30	lb.	.0125	.021
521	lb.	.019	.02
Bunarex resins	lb.	.065	.1225
Cab-o-sil (compressed)	lb.	.81	
Calcene NC	ton	72.50	92.50
TM	ton	75.00	95.00
Calco S. A.	lb.	.85	.88
Carbonex S	lb.	.0475	.05
Clays			
Aiken	ton	14.00	
Aluminum Flake	ton	20.00	60.00
#5	ton	23.50	26.50
Buca	ton	40.00	
Burgess Iceberg	ton	50.00	
Pigment No. 20	ton	35.00	
30	ton	37.00	
Catalpo	ton	30.00	
Crown	ton	14.00	33.00
Dixie	ton	14.00	
L. G. B.	ton	17.00	
Paragon (R)	ton	13.50	33.00
Pigment No. 33	ton	30.00	
Suprex	ton	14.00	33.50
Witco No. 1	ton	14.00	30.00
No. 2	ton	13.50	30.00
Clearcarb	lb.	.1175	.1225
Cumar EX	lb.	.0525	
MH	lb.	.065	.1175
V	lb.	.0975	.1275
Good-rite Resin 50	lb.	.42	.45
K Series Polymers	lb.	.15	.37
Hi-Sil 101	lb.	.10	.115
202	lb.	.11	.125
Kralac A-EP	lb.	.43	.54
Marbon resins	lb.	.42	.49
Multifex	ton	140.00	155.00
MM	ton	110.00	125.00
Neville R. Resins	lb.	$0.10	$0.155
Para Resins 2457, 2718	lb.	.04	.45
Pico Resins	lb.	.13	.185
Piccolyte Resins	lb.	.185	.25
Piccoumaron Resins	lb.	.07	.185
Piccovars	lb.	.145	.20
Pliolite NR types	lb.	.98	1.33
S-3, -6, -6B	lb.	.42	.49
Resin C Pitch	lb.	.0225	.031
Resinex	lb.	.0325	.0375
Rubber Resin LM-4	lb.	.28	.35
S-Polymers	lb.	.44	
Silene EF	ton	120.00	140.00
Silvacons	ton	55.00	85.00
Super Multifex	ton	160.00	175.00
Witcarb R	ton	105.00	120.00
-12	ton	45.00	66.00
Zeolex 20	ton	120.00	140.00
Zinc oxide, commercial†	lb.	.135	.1675

Retarders

Cumar RH	lb.	.105	
Delac J	lb.	.55	.60
E-S-E-N	lb.	.35	.37
Good-rite Vultrol	lb.	.62	.66
R-17 Resin	lb.	.1075	.36
Retarder ASA	lb.	.57	
PD	lb.	.35	.37
TCM	lb.	.65	
W	lb.	.45	
Retardex	lb.	.47	.50
RM	lb.	1.25	
Thionex	lb.	1.25	

Solvents

2-50-W Hi-Flash Solvent	gal.	.41	
3-BX Naphtha	gal.	.37	
Bondogen	lb.	.55	.60
Cosols	gal.	.37	.48
Dichloro Pentanes	lb.	.04	.07
Dipentene DD	gal.	.445	.68
GVL	lb.	1.00	
LX-572 Oil	gal.	.27	.32
-748 Solvent	gal.	.16	.23
Nevsol H	gal.	.19	.29
HF, T	gal.	.24	.34
Penetrell	gal.	.445	.68
Picco Hi-Solv Solvents	gal.	.19	.45
Pine Oil DD	gal.	.755	.955
PT 150 Pine Solvent	gal.	.44	
Skellysolve-E	gal.	.153	
-H	gal.	.133	
-R, -V	gal.	.109	
-S	gal.	.099	

Synthetic Resins

Geon Latices (dry wt.)	lb.	.38	.52
Paste Resins	lb.	.38	.59
Plastics	lb.	.35	.80
Polyblend	lb.	.475	.575
Polyvinyl resins	lb.	.38	.70
Kenflex A, L	lb.	.26	.27
B	lb.	.23	.24
N	lb.	.18	.19
Kralastic	lb.	.65	1.30
Marvinol VR-10, -20	lb.	.36	.52
Plio-Tuf G75C, G85C	lb.	.52	.58

Synthetic Rubber and Latices

Butaprene Latex (dry wt.)			
NL types	lb.	.47	.52
NXM types	lb.	.55	.60
Butaprene NAA	lb.	.54	.55
NF	lb.	.49	.50
NL	lb.	.50	.51
NXM	lb.	.58	.59
Chemigum 30N4NS, 50N4NS	lb.	.50	.52
N1NS	lb.	.64	.66
N3NS	lb.	.58	.60
N6, N7	lb.	.50	.52
Chemigum Latex (dry wt.)			
101 types	lb.	.35	.42
200, 245 types	lb.	.47	.55
235 types	lb.	.55	.63
Hycar 1001, 1011	lb.	.58	.59
1002, 1012	lb.	.50	.51
1022	lb.	.51	.52
1411	lb.	.62	.63
2001	lb.	.55	.56
4021	lb.	1.34	1.35
Hycar Latex (dry wt.)			
1551, 1561	lb.	.55	.60
1552, 1562	lb.	.47	.52
Neoprene Latex (dry wt.)			
Type 571, 842-A	lb.	.37	.48
572	lb.	.39	.50
601-A, 735	lb.	.40	.51
735	lb.	.38	.49
Neoprene Type AC, CG	lb.	.55	.80
GN, GN-A, W, WHV	lb.	.41	.44
GRT, S	lb.	.42	.45
KNR	lb.	.75	.78
Q	lb.	1.00	1.03
WRT	lb.	.45	.48
Paracril 18-80	lb.	.60	.61
AJ	lb.	.485	.495
Paracril			
B, BJ	lb.	.50	.51
BV	lb.	.51	.52
C	lb.	.58	.59
CS, CV	lb.	.59	.60
Paraplex X-100	lb.	1.00	
Silastic	lb.	2.30	4.05

CLASSIFIED ADVERTISEMENTS

Continued

MACHINERY & SUPPLIES WANTED

WANTED: PLANT OR MACHINERY INCL. RUBBER MILLS, CALenders, Mixers, Banbury Mixers, Extruders, Grinders, Cutters, Hydraulic Presses, Injection Molding Machines. CONSOLIDATED PRODUCTS CO., INC., 64 Bloomfield Street, Hoboken, N. J. BArclay 7-0600.

WANTED TO BUY: DOUBLE-ARM JACKETED MIXERS, UP TO 50 gallons; heavy-duty vulcanizers; laboratory-size rubber mills; rotary cutters and grinders. Address Box No. 1458, care of INDIA RUBBER WORLD.

WANTED: BANBURY MIXER BODIES AND PARTS, ANY SIZE. Write INTERSTATE WELDING SERVICE, Metropolitan Bldg., Akron 8, Ohio.

WANTED: EXTRUDER, NO. 2 ROYLE OR EQUIVALENT. MIGHT be able to use slightly larger machine. Address Box No. 1461, care of INDIA RUBBER WORLD.

MISCELLANEOUS

NYLON

ALL DESCRIPTIONS: R.O.M.'s, 2ND's, SHORTS. ATTRACTIVELY PRICED. INDUSTRALON FABRICS, 366 Broadway, N.Y.C. WOrth 2-0631.

The Classified Ad Columns of INDIA RUBBER WORLD bring prompt results at low cost.

BUSINESS OPPORTUNITIES

CANADIAN RUBBER PLANT FOR SALE. IDEAL FOR U.S. COMpany wanting to establish subsidiary. Completely equipped small factory making range of mechanicals and cements. Address Box No. 1460, care of INDIA RUBBER WORLD.

WE WISH TO PURCHASE OUTRIGHT

A Rubber Plant making mechanical goods doing a volume of no less than $500,000.00 per annum. All replies will be held in strict confidence.

ADDRESS BOX NO. 1449
C/O India RUBBER WORLD

Custom Mixing RUBBER-PLASTICS

We do milling and compounding of all types—black or color—master batches

All mixing done under careful supervision and laboratory control.

Phone: Butler 9-0400

Pequanoc Rubber Co.
MANUFACTURERS OF RECLAIMED RUBBER
MAIN SALES OFFICE and FACTORY, BUTLER, N. J.

TJIPETIR WHITE GUTTA PERCHA

the outstanding material for

GOLF BALL COVERS—
HIGH FREQUENCY INSULATION—BELTING, etc.

again available in limited quantities

for prices and details apply

JACOBUS F. FRANK
Repr. INDONESIAN GOVT. ESTATES
120 Wall Street • New York 5, N. Y.
Telephone: WHitehall 3-0663

Black White Colors

CUSTOM RUBBER MILLING

Preparation of master batches and complete compounds of every type to meet your specifications and requirements.

ABC RUBBER CO.
1451 So. Sangamon St., Chicago 8, Illinois
Telephone: Taylor 9-0644

MANUFACTURING BUSINESS WANTED

We are now manufacturing over $20,000,000 in various lines and wish to expand by acquisition of assets or stock of one or more industrial companies. In our negotiations the sellers' problems and wishes will receive full consideration. Present personnel will normally be retained.
Address all replies "confidentially" C. J. GALE, Sec.,
233 Broadway, New York 7, N. Y. RE 2-9360

MIXING

To Your Specification

K. B. C. INDUSTRIES, INC. **NEW HAVEN, CONN.**
881 State Street Tel: State 7-5662
Otto J. Lang, General Manager

Rubber Plastic Synthetics
Precision Workmanship

CALENDERING & MIXING

Rubber & Plastics: Calendering, Mixing, Grinding & Pulverizing

AS YOU WANT IT. QUICK SERVICE

The Saniseal Mfg. Co. P. O. Box 1315
New Haven, Conn. Tel. Spruce 7-3437

Custom Mixing

55 YRS. KNOW-HOW
NEW FACILITIES—
HARD & SOFT RUBBER FORMULAS

✓ MASTER BATCHES
✓ MILL MIX
✓ BANBURY-UP TO #11
✓ DUST GRINDING

Call Trenton 2-7153

STOKES MOLDED PRODUCTS
CUSTOM MOLDERS-HARD RUBBER & PLASTICS
TRENTON 4, N. J.

Thiokol LP-2, -3	lb.	$0.96	
-8	lb.	1.25	
PR-1	lb.	1.95	
Type A	lb.	.47	
FA	lb.	.64	
ST	lb.	1.00	
Thiokol Latex (dry wt.)			
Type MF	lb.	.85	
MX	lb.	.70	
WD-2	lb.	.92	
-6	lb.	.70	

Tackifiers

Bunarex resins	lb.	.065 /	$0.1225
Chlorowax 70	lb.	.18 /	.24
Contogums	lb.	.0875 /	.11
Galex W-100	lb.	.155 /	.1925
W-100D	lb.	.1525 /	.19
Indopol H-100	gal.	.85 /	1.00
H-300	gal.	1.00 /	1.16
Natac	lb.	.12 /	.13
Nevindene	lb.	.15 /	.18
Picco Resins	lb.	.13 /	.185
Piccolastic Resins	lb.	.1855 /	.34
Piccolyte Resins	lb.	.185 /	.25
Piccopale Resins	lb.	.12 /	.135
Piccoumaron Resins	lb.	.07 /	.185

Synthetic 100	lb.	$0.41	
Synthol	lb.	.2475 /	$0.2625

Vulcanizing Agents

Dibenzo G-M-F	lb	2.60	
G-M-F #113	lb.	.90	
G-M-F	lb.	2.60	
#117	lb.	.90	
Ko-Blend I, S	lb.	.385	
Litharge, commercial	lb.	.145 /	.15
Eagle, sublimed	lb.	.145 /	.146
Magnesium oxide	lb.	.23 /	.25
Red lead, commercial	lb.	.155 /	.165
Eagle	lb.	.155	
Sulfasan R	lb.	1.50	
Sulfur flour, comml	100 lbs.	2.30 /	3.05
Calco	100 lbs.	2.15 /	7.50
Crystex	lb.	.195	
Insoluble 60	lb.	.125 /	.13
Rubbermakers	100 lbs.	2.40 /	4.30
Stauffer	lb.	.0215 /	.0335
Telloy	lb.	2.50	
Vandex	lb.	4.75	
Vultac No. 2	lb.	.47 /	.755
3	lb.	.51 /	.795
White lead silicate	lb.	.1525 /	.1875
Eagle	lb.	.17 /	.1875
National Lead	lb.	.1525 /	.1625

United States Imports, Exports, and Reexports of Crude and Manufactured Rubber

Imports for Consumption of Crude and Manufactured Rubber

	October, 1953 Quantity	Value
UNMANUFACTURED, LBS.		
Crude rubber	90,030,291	$18,037,134
Latex	14,643,577	3,844,351
Balata	112,568	23,033
Jelutong or Pontianak	227,349	110,166
Gutta percha	22,434	18,363
Crude chicle	229,942	123,670
Synthetic rubber	1,784,430	480,990
Reclaimed rubber	413,869	40,431
Scrap rubber	2,990,151	133,602
TOTALS	110,454,611	$22,811,740
MANUFACTURED		
Rubber tires		
Auto, etc. ... no.	5,947	$251,969
Bicycle ... no.	9,693	8,965
Inner tubes		
Auto, etc. ... no.	730	2,499
Footwear		
Boots ... prs.	6,826	16,617
Shoes and overshoes ... prs.	38,310	24,201
Rubber-soled canvas shoes ... prs.	4,583	4,498
Athletic balls		
Golf ... no.	30,120	8,293
Tennis ... no.	144	480
Other ... no.	111,650	13,956
Toys	......	25,046
Hard rubber goods		
Combs ... no.	42,480	3,965
Drug sundries	......	117
Other	......	2,724
Rubberized printing blankets ... lbs.	192	265
Rubber and cotton packing ... lbs.	2,458	4,420
Gasket and valve packing	......	2,278
Molded insulators	......	3,695
Belting ... lbs.	21,492	26,992
Hose and tubing	......	16,485
Gloves ... prs.	43,071	6,068
Nipples and pacifiers ... gr.	1,280	1,803
Instruments ... doz.	2,215	6,567
Soles and heels ... lbs.	4,051	2,455
Bands ... lbs.	5,253	2,630
Other	......	381
Gutta percha manufactures ... lbs.	2,718	2,921
Synthetic rubber products	......	513
Other soft rubber goods	......	162,985
TOTALS	......	$603,788
GRAND TOTALS, ALL RUBBER IMPORTS	......	$23,415,528

Reexports of Foreign Merchandise

UNMANUFACTURED, LBS.		
Crude rubber	1,472,123	$355,170
Balata, gutta percha, etc.	7,276	2,714
Chicle and chewing gum bases	4,000	1,160
TOTALS	1,483,399	$359,044

Exports of Domestic Merchandise

	October, 1953 Quantity	Value
UNMANUFACTURED, LBS.		
Crude rubber	13,376	$3,232
Chicle and chewing gum bases	619,525	257,894
Balata, gutta percha, etc.	1,750	4,255
Synthetic rubbers		
GR-S types	1,019,017	284,582
Butyl	7,963	1,820
Neoprene	2,049,540	921,251
Nitrile type	678,034	351,490
Other	79,924	57,744
Reclaimed rubber	1,844,457	160,983
Scrap rubber	3,541,996	95,996
TOTALS	9,855,582	$2,139,247
MANUFACTURED		
Rubber cement ... gals.	52,549	$115,193
And rubberized fabric ... sq. yds.	227,880	217,192
Clothing	......	170,202
Footwear		
Boots and shoes ... prs.	23,305	46,961
Rubber-soled canvas shoes ... prs.	21,089	38,165
Heels ... doz. prs.	72,313	72,517
Soles, soling, top-lift sheets ... lbs.	931,276	232,430
Gloves and mittens ... doz. prs.	14,669	73,640
Drug sundries	......	234,411
Toys, balls, novelties	......	88,199
Hard rubber goods		
Battery boxes ... no.	34,980	74,549
Other electrical goods ... lbs.	86,931	59,091
Other	......	19,823
Rubber tires and casings		
Truck and bus ... no.	67,869	$3,431,913
Auto and motorcycle ... no.	69,211	904,699
Aircraft ... no.	1,505	78,185
Off-the-road ... no.	9,608	963,248
Farm tractor ... no.	3,456	134,827
Implement ... no.	807	18,833
Other ... no.	9,071	36,255
Inner tubes		
Auto ... no.	34,746	79,906
Truck and bus ... no.	39,897	174,533
Aircraft ... no.	220	4,212
Other ... no.	9,102	46,124
Solid tires		
Truck and commercial ... lbs.	1,961	39,676
Tire repair material		
Camelback ... lbs.	571,092	164,981
Other ... lbs.	256,192	209,837
Tape, except medical and friction ... lbs.	55,784	62,532
Belting		
V-type, vehicle, fan ... lbs.	80,544	108,818
Transmission		
V-type ... lbs.	84,920	179,574
Flat belts ... lbs.	56,382	75,145
Conveyor and elevator ... lbs.	275,129	309,800
Other ... lbs.	5,408	10,430
Hose		
Molded and braided ... lbs.	288,096	230,198
Wrapped and hand built ... lbs.	94,074	101,129
Other hose and tubing ... lbs.	104,429	135,914
Packing		
Sheet type ... lbs.	39,715	24,865
Other ... lbs.	128,749	189,483
Tiling and flooring ... lbs.	174,910	57,645
Mats and matting ... lbs.	393,644	136,654
Thread: bare ... lbs.	22,843	35,976
Textile covered ... lbs.	30,898	82,870
Compounded rubber for further manufacture ... lbs.	439,576	194,694
Other rubber manufactures	......	528,433
TOTALS	......	$10,193,762
GRAND TOTALS, ALL RUBBER EXPORTS	......	$12,333,009

Source: Bureau of the Census, United States Department of Commerce, Washington, D. C.

Trade Lists Available

The Commercial Intelligence Division recently published the following trade lists, of which mimeographed copies may be obtained by firms domiciled in the United States from this Division and from Department of Commerce Field Offices. The price is $1 a list for each country.

Aircraft & Aeronautical Supply & Equipment Importers & Dealers: Morocco.

Automotive Vehicle & Equipment Importers & Dealers: British Guiana; Netherlands; Netherlands West Indies.

Boot & Shoe Manufacturers: Peru.

Chemical Importers & Dealers: Australia; El Salvador; Turkey.

Dental Supply Houses: Morocco.

Tire Retreaders, Recappers, and Repairers: India.

United States Rubber Statistics — November, 1953

(All Figures in Long Tons, Dry Weight)

	New Supply			Distribution		
	Production	Imports	Total	Consumption	Exports	Month-End Stocks
Natural rubber and latex, total	0	49,454	49,454	43,251	1,107	112,677
Rubber, total	0	44,917	44,917	38,017	1,107	101,843
Latex, total	0	4,537	4,537	5,234	0	10,834
Synthetic rubbers, total	*48,169 †9,052	749	57,970	52,670	2,304	166,523
GR-S types‡	*42,167 †138	715	43,020	41,604	729	127,464
Butyl	*6,002	34	6,036	4,919	11	23,401
Neoprene‡	†7,137	0	7,137	4,911	1,155	11,067
Nitrile type‡	†1,777	0	1,777	1,236	409	4,591
Natural rubber and latex, and synthetic rubbers, total	57,221	50,203	107,424	95,921	3,411	279,200
Reclaimed rubber, total	21,191	132	21,323	19,638	1,086	31,226
GRAND TOTALS	78,412	50,335	128,747	115,559	4,497	310,426

*Government plant production.
†Private plant production.
‡Includes latices.
SOURCE: Chemical & Rubber Division, BDSA, United States Department of Commerce, Washington, D. C.

INDEX TO ADVERTISERS

This index is maintained for the convenience of our readers. It is not a part of the advertisers' contract and INDIA RUBBER WORLD *assumes no responsibility to advertisers for its correctness.*